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Personal Computing

For Your Home and Business

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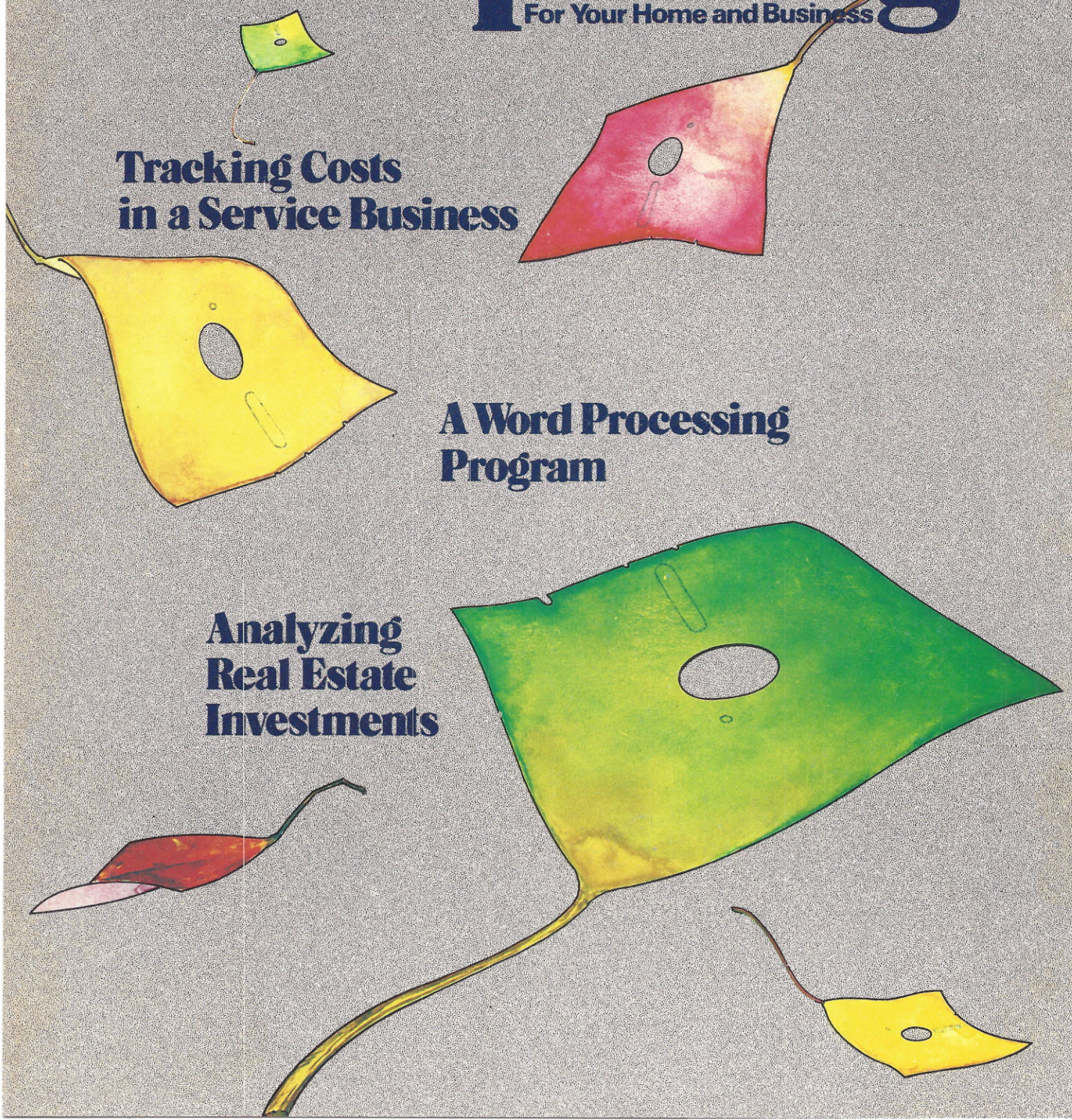


The Anadex 80 Column Printer.

First check the specs. Then check the price.

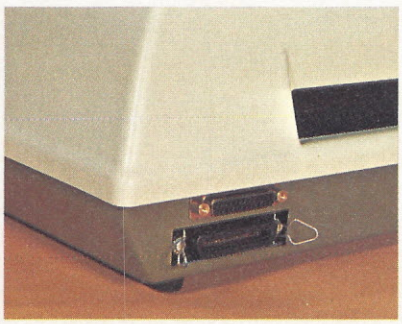
Our new 80-column dot matrix line printer – the DP-8000 – combines high performance and operating convenience with a low price that's worth checking into.

☑ Check Performance

The DP-8000 features a precision engineered, heavy duty printing mechanism that can print the complete 96 ASCII character set, bi-directionally, at 84 LPM.

☑ Check the Interface

Included at no extra cost, are two input connectors (see photo) that provide three basic ASCII compatible interfaces: EIA Std. RS232C, for interfacing at up to 9600 Baud with most mini-computers and modems; the 20/60 ma current drive mode required by Teletype® ASR33-35 printers; and the parallel-bit, serial character synchronous Centronics compatible interface.



The DP-8000 includes 12 lines of internal FIFO buffer storage and can accept data continuously or in bursts. Optionally, increased buffer storage of 2048 characters can be supplied for CRT dump and similar applications.

☑ Check Printer Quality

A 9 × 7 character font provides virtually half-dot resolution for clean crisp print quality on the original plus three copies.

Precise paper positioning is ensured by a sprocket-feed paper advance, user-programmable Top of Form control, and up to 8 vertical tab positions.

☑ Check Convenience

For operating ease, the DP-8000 accepts paper through the rear or bottom of the unit, provides programmable Skip Over Perforation control, and Out of Paper indication and logic signal. And movable sprockets allow the use of forms or paper from under 3 inches to 9½ inches wide.

☑ Check the low Price

The best news is the price. A complete DP-8000 is unit-priced at under $1000, with substantial discounts in larger quantities.

Once you've checked out the performance and price, we think you'll agree that the DP-8000 is definitely worth checking into. Contact us today for complete details and a demonstration.

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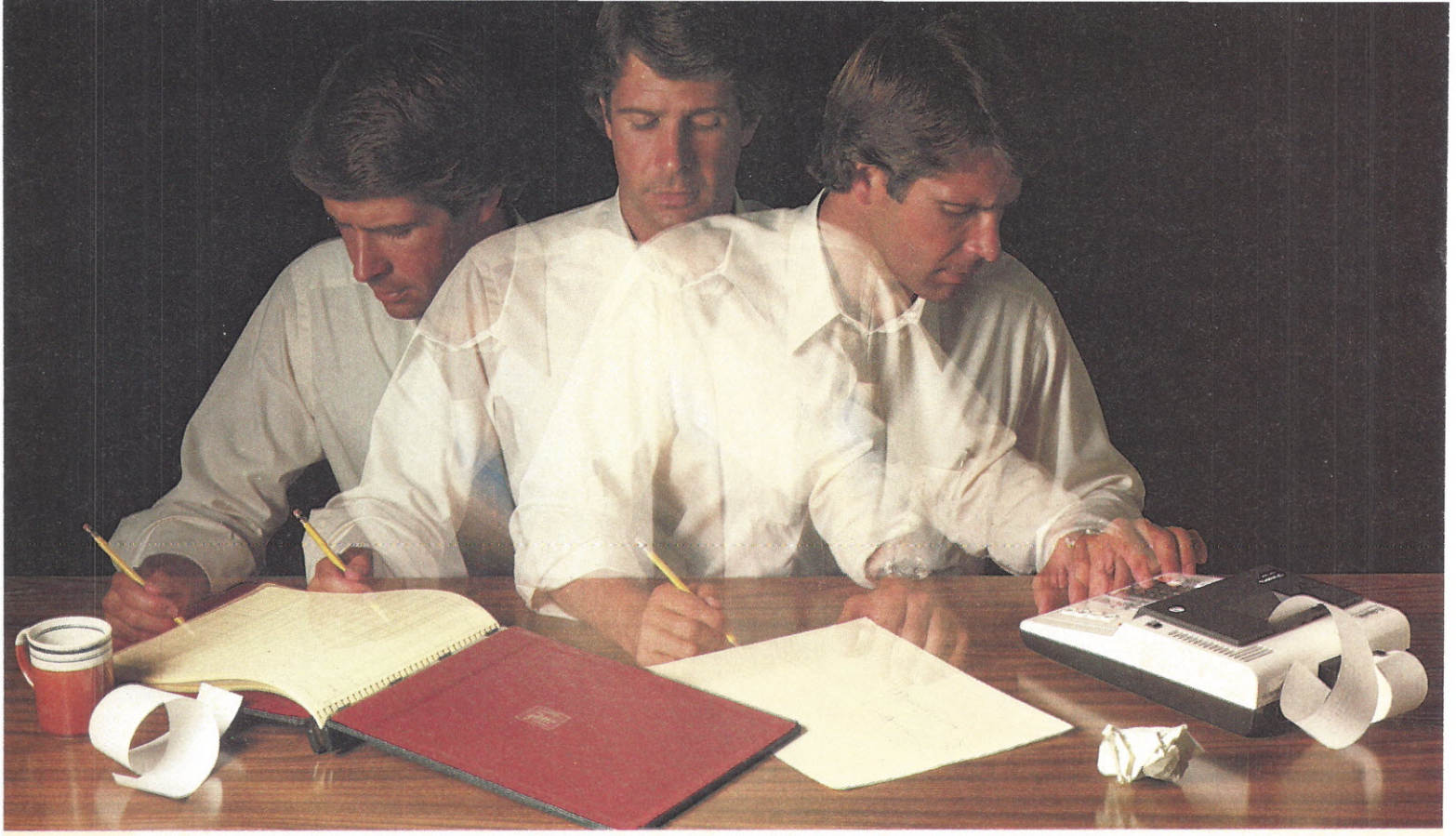
CIRCLE 1



Solve your personal energy crisis. Let VisiCalc™ Power do the work.

With a calculator, pencil and paper you can spend hours planning, projecting, writing, estimating, calculating, revising, erasing and recalculating as you work toward a decision.

Or with VisiCalc and your Apple* II you can explore many more options with a fraction of the time and effort you've spent before.

VisiCalc is a new breed of problem-solving software. Unlike prepackaged software that forces you into a computerized straight jacket, VisiCalc adapts itself to any numerical problem you have. You enter numbers, alphabetic titles and formulas on your keyboard. VisiCalc organizes and displays this information on the screen. You don't have to spend your time programming.

Your energy is better spent using the results than getting them.

Say you're a business manager and want to project your annual sales. Using the calculator, pencil and paper method, you'd lay out 12 months across a sheet and fill in lines and columns of figures on products, outlets, salespeople, etc. You'd calculate by hand the subtotals and summary figures. Then you'd start revising, erasing and recalculating. With VisiCalc, you simply fill in the same figures on an electronic "sheet of paper" and let the computer do the work.

Once your first projection is complete, you're ready to use VisiCalc's unique, powerful recalculation feature. It lets you ask "What if?," examining new options and planning for contingencies. "What if" sales drop 20 percent in March? Just type in the sales figure. VisiCalc instantly updates all other figures affected by March sales.

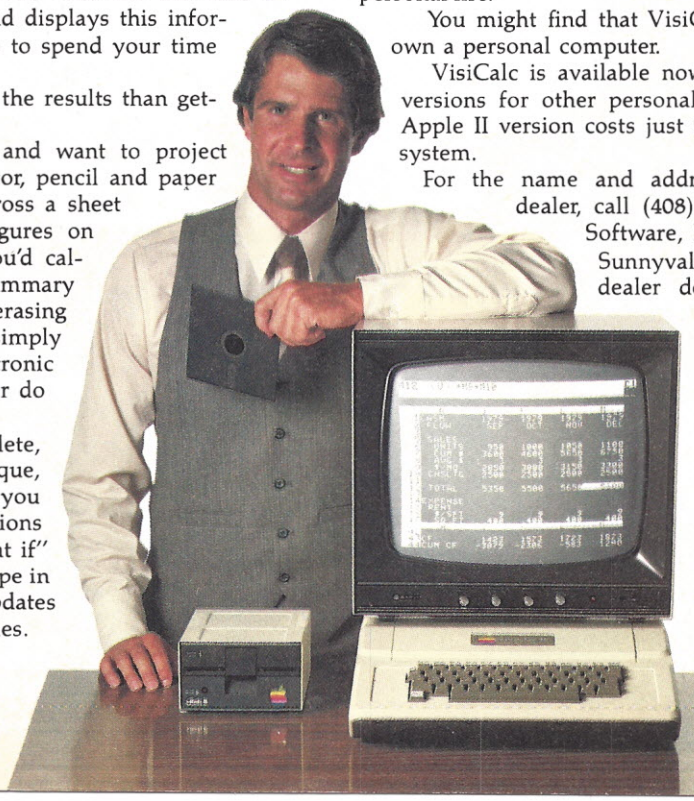
Or say you're an engineer working on a design problem and are wondering "What if that oscillation were damped by another 10 percent?" Or you're working on your family's expenses and wonder "What will happen to our entertainment budget if the heating bill goes up 15 percent this winter?" VisiCalc responds instantly to show you all the consequences of any change.

Once you see VisiCalc in action, you'll think of many more uses for its power. Ask your dealer for a demonstration and discover how VisiCalc can help you in your professional work and personal life.

You might find that VisiCalc alone is reason enough to own a personal computer.

VisiCalc is available now for Apple II computers with versions for other personal computers coming soon. The Apple II version costs just $99.50 and requires a 32k disk system.

For the name and address of your nearest VisiCalc dealer, call (408) 745-7841 or write to Personal Software, Inc., Dept. P, 592 Weddell Dr., Sunnyvale, CA 94086. If your favorite dealer doesn't already carry Personal Software products, ask him to give us a call.



PERSONAL SOFTWARE

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CIRCLE 3

YOUR COMPANY!

Pictured from left to right starting in first row: Del, Sturgis, Linda, Alan, Sandy, Cassandra, Gail, Frank, Dosse, Dale, Mike, Barry. Carol and Brian are not pictured.

The Bottom Shelf works for you, the computer owner. Our sole function is to design programs and products to help you use your computer as it should be used, a useful tool to ease your workload or make profits.

TBS is a company of fourteen people; people who have literally risked their careers and financial security to be involved in the most exciting industry of the Eighty's. TBS is not a large company, nor is it affiliated with any large organization. We have grown in one year from two to fourteen people, a direct result of your aid, support and purchases of our products. In the past five months, TBS has spent in excess of $100,000.00 designing software and new products for your use; products we feel are the best in the industry! Now, we need your help. We need your orders to support future developments and to help the microcomputer field grow to its fullest potential.

Contact your local computer store or Associate Radio Shack store for a copy of **SYSTEMS EXTENSIONS** ($3.00) for a full list of our products and 17 interesting and informative articles designed to help you more fully utilize your computer. We now offer the following software for the TRS-80: • **LIBRARY 100**, a basic computer library consisting of 100 programs for business, education, graphics, home use and games — $49.50; • **TBS BUSINESS MAIL SYSTEM** for dual disk and printer, can handle up to 150,000 names — $125.00; • **CHECKBOOK II**, cassette and disk based personal finance — $18.50; • **BASIC TOOLKIT**, a machine language programmer's aid — $19.80; • **SYSTEM DOCTOR**, a computer diagnostic program — $28.50; • **ANALYSIS PAD**, a columnar calculator — $32.50; • **INFORMATION SYSTEM**, an "in-mem" data base manager — $24.50; • **EXERCISER**, for establishing physical fitness regimens — $12.50; • **TERMINAL CONTROL**, for RS-232 telecommunications — $19.80; • **CHECK REGISTER ACCOUNTING SYSTEM**, for dual disk and printer, complete accounting — $49.50. We also have **DISK HEAD CLEANERS** for TRS-80 and APPLE — $12.95, and **GRAN MASTER DISKETTES**, the best on the market — $38.00 for 10.

The above products are available **now** at computer stores nationwide or directly through TBS. For more information, contact us through the number below.

Through our products and our service, we at TBS look forward to a long happy relationship with you, the computer owner.

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Personal Computing

For Your Home and Business

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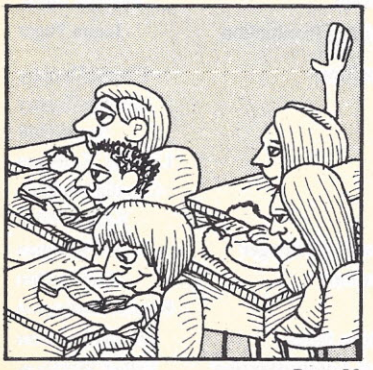

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DIGGING IN

Coin Collecting 30
These two programs let collectors store and retrieve information about their coins. *by Charles D. Sternberg*

Basic Renumbering 44
Program renumbering is a powerful utility that adds flexibility to your programming efforts. This program, written for a Heath H-8 computer, can be implemented on other systems as well. *by Charles K. Ballinger*

The Computer Glass Box 50
This article, written by a University of Massachusetts professor, introduces the APL programming language by showing how programs written in APL can be used to teach various classroom subjects. *by Howard A. Peelle*

A Novel Program 54
Here's a word processing program to let you easily produce flawless text — whether you're writing a simple business letter or a long novel. *by Charley Winterbauer*

IN THE MONEY

Viewing Real Estate Investments 22
Using this program, prospective buyers can evaluate various real estate options to determine the most profitable investments. *by Larry L. Severson*

Tracking Costs in a Service Business 26
Small businesses can use this program to easily determine the costs for products and services by a number of categories, including employee and product or service type. *by Clint Hentz*

ON THE LIGHTER SIDE

Baseball For All Seasons 37
You can enjoy a rousing game of baseball even in the dead of winter with this program and an HP25 programmable calculator. *by Leonard S. Magerman*

Minotaur's Malevolent Maze 40
Written for the TRS-80, this exciting game challenges your skill as you try to maneuver through a constantly shifting maze of walls. *by David Lappen*

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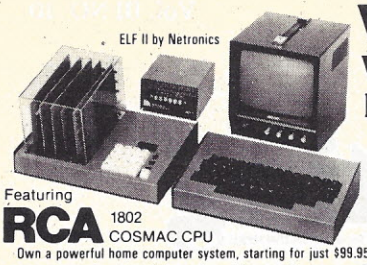

Write and run programs–the very first night–even if you've never used a computer before!

You're up and running with video graphics for just $99.95 — then use low cost add-ons to create your own personal system that rivals home computers sold for 5-times ELF II's low price!

Featuring **RCA** 1802 COSMAC CPU

Own a powerful home computer system, starting for just $99.95–a price that gets you up and running the very first night...with your own TV for a video display. $99.95 ELF II includes RCA 1802 8-bit microprocessor addressable to 64k bytes with DMA, interrupt, 16 registers, ALU, 256 byte RAM, full hex keyboard, two digit hex output display, stable crystal clock for timing purposes, RCA 1861 video IC to display your programs on any video monitor or TV screen *and 5-slot plug-in expansion bus (less connectors) to expand ELF II into a giant!*

ELF II Explodes Into A Giant!

Master ELF II's $99.95 capabilities, then expand with GIANT BOARD ... KLUGE BOARD...4k RAM BOARDS...TINY BASIC...ASCII KEYBOARD... LIGHT PEN...ELF-BUG MONITOR...COLOR GRAPHICS & MUSIC SYSTEM... TEXT EDITOR...ASSEMBLER...DISASSEMBLER...VIDEO DISPLAY BOARD ...*and,* another great reason for getting your ELF now–

BREAKTHROUGH!

Netronics proudly announced the release of the first 1802 FULL BASIC, written by L. Sandlin, with a hardware floating point RPN math package (requires 8k RAM plus ASCII and video display boards), $79.95 plus $2 p&h. Also available for RCA VIP and other 1802 systems (send for details)!

Master This Computer In A Flash!

Regardless of how minimal your computer background is now, you can learn to program an ELF II in almost no time at all. Our *Short Course On Microprocessor & Computer Programming*–written in non-technical language–guides you through each of the RCA COSMAC 1802's capabilities, so you'll understand *everything* ELF II can do...*and how to get ELF II to do it!* Don't worry if you've been stumped by computer books before. The *Short Course* represents a major advance in literary clarity in the computer field. You don't have to be a computer engineer in order to understand it. Keyed to ELF II, it's loaded with "hands on" illustrations. When you're finished with the *Short Course*, neither ELF II nor the RCA 1802 will hold any mysteries for you.

In fact, not only will you now be able to use a personal computer creatively, you'll also be able to read magazines such as BYTE...INTERFACE AGE...POPULAR ELECTRONICS and PERSONAL COMPUTING and fully *understand* the articles. And, you'll understand how to expand ELF II to give you the exact capabilities you need!

If you work with large computers, ELF II and the *Short Course* will help you understand what they're doing.

Get Started For Just $99.95, Complete!

$99.95 ELF II includes all the hardware and software you need to start writing and running programs at home, displaying video graphics on your TV screen and designing circuits using a microprocessor–the very first night–even if you've never used a computer before.

ELF II connects directly to the video input of your TV set, without any additional hardware. Or, with an $8.95 RF modulator (see coupon below), you can connect ELF II to your TV's antenna terminals instead.

ELF II has been designed to play all the video games you want, including a fascinating new target/missile gun game that was developed specifically for ELF II. But games are only the icing on the cake. The real value of ELF II is that it gives you a chance to write machine language programs–and machine language is the fundamental language of all computers. Of course, machine language is only a starting point. You can also program ELF II with assembly language and tiny BASIC. But ELF II's machine language capability gives you a chance to develop a working knowledge of computers that you can't get from running only pre-recorded tape cassettes.

ELF II Gives You The Power To Make Things Happen!

Expanded, ELF II can give you more power to make things happen in the real world than heavily advertised home computers that sell for a lot more money. Thanks to an ongoing committment to develop the RCA 1802 for home computer use, the ELF II products–being introduced by Netronics–keep you right on the outer fringe of today's small computer technology. It's a perfect computer for engineering, business, industrial, scientific and personal applications.

Plug in the **GIANT BOARD** to record and play back programs, edit and debug programs, communicate with remote devices and make things happen in the outside world. Add **Kluge** (prototyping) **Board** and you can use ELF II to solve special problems such as operating a complex alarm system or controlling a printing press. Add **4k RAM Boards** to write longer programs, store more information and solve more sophisticated problems.

ELF II add-ons already include the **ELF II Light Pen** and the amazing **ELF-BUG Monitor**–two extremely recent breakthroughs that have not yet been duplicated by any other manufacturer.

The ELF-BUG Monitor lets you debug programs with lightening speed because the key to debugging is to know what's inside the registers of the microprocessor. And, with the ELF-BUG Monitor, instead of single stepping through your programs, you can now display the entire contents of the registers on your TV screen. You find out immediately what's going on and can make any necessary changes.

The incredible ELF II Light Pen lets you write or draw anything you want on a TV screen with just a wave of the "magic wand." Netronics has also introduced the ELF II Color Graphics & Music System–more breakthroughs that ELF II owners were the first to enjoy!

ELF II Tiny BASIC

Ultimately, ELF II understands only machine language–the fundamental coding required by all computers. But, to simplify your relationship with ELF II, we've introduced an **ELF II Tiny BASIC** that makes communicating with ELF II a breeze.

Now Available! Text Editor, Assembler, Disassembler And A New Video Display Board!

The Text Editor gives you word processing ability and the ability to edit programs or text while it is displayed on your video monitor. Lines and characters may be quickly inserted, deleted or changed. Add a printer and ELF II can type letters for you–error free–plus print names and addresses from your mailing list!

ELF II's **Assembler** translates assembly language programs into hexidecimal machine code for ELF II use. The Assembler features mnemonic abbreviations rather than numerics so that the instructions on your programs are easier to read–this is a big help in catching errors.

ELF II's **Disassembler** takes machine code programs and produces assembly language source listings. This helps you understand the programs you are working with...and improve them when required.

The new **ELF II Video Display Board** lets you generate a sharp, professional 32 or 64 character by 16 line upper and lower case display on your TV screen or video monitor–dramatically improving your unexpanded $99.95 ELF II. When you get into longer programs, the Video Display Board is a real blessing!

Now Available!

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☐ **PILOT Language**—A *new* **text-oriented** language that allows you to write educational programs on ELF II with speed and ease! Write programs for games...unscrambling sentences...spelling drills..."fill in the missing word" tests, etc.! PILOT is a must for any ELF II owner with children. *PILOT Language on cassette tape, only $19.95 postpaid!*

☐ **Game Package** on cassette tape (requires 4k RAM), **$9.95** plus $2 postage & handling.

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☐ RCA 1802 User's Manual $5 postpaid

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☐ Deluxe Metal Cabinet with plexiglas dust cover for ELF II. $29.95 plus $2.50 p&h

☐ I am also enclosing payment (including postage & handling) for the items checked below!

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☐ **GIANT BOARD™** kit with cassette I/O, RS-232-C/TTY I/O, 8-bit P.I/O, decoders for 14 separate I/O instructions and a system monitor/editor **$39.95** plus $2 p&h

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☐ **4k Static RAM kit**. Addressable to any 4k page to 64k **$89.95** plus $3 p&h

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☐ **Deluxe metal cabinet for ASCII Keyboard. $19.95** plus $2.50 p&h

☐ **Video Display Board** kit lets you generate a sharp, professional 32 or 64 character by 16 line upper and lower case display on your tv screen or video monitor—dramatically improving your unexpanded $99.95 ELF II. (Fits inside ASCII Keyboard cabinet.) **$89.95** plus $2 p&h

☐ **ELF II Tiny BASIC** on cassette tape. Commands include SAVE, LOAD, ±, ×, ÷, (), 26 variables A-Z, LET, IF/THEN, INPUT, PRINT, GO TO, GO SUB, RETURN, END, REM, CLEAR, LIST, RUN, PLOT, PEEK, POKE. Comes fully documented and includes alphanumeric generator required to display alphanumeric characters directly on your tv screen without additional hardware. Also plays tick-tack-toe plus a drawing game that uses ELF II's hex keyboard as a joystick. 4k memory required. **$14.95** postpaid

☐ Tom Pittman's **Short Course on Tiny Basic** for ELF II. **$5** postpaid

☐ **ELF-BUG™ Deluxe System Monitor** on cassette tape. Allows displaying the contents of all registers on your tv at any point in your program. Also displays 24 bytes of memory with full addresses, blinking cursor and auto scrolling. A must for the serious programmer! **$14.95** postpaid

☐ **Text Editor** on cassette tape gives you the ability to insert, delete or edit lines and words from your programs while they are displayed on your video monitor. (Add printer and you can use ELF II to type error-free letters, plus insert names and addresses from your mailing list.) **$19.95** postpaid

☐ **Assembler** on cassette tape translates assembly language programs into hexidecimal machine code for ELF II use. Mnemonic abbreviations for instructions (rather than numerics) make programs easier to read and help prevent errors. **$19.95** postpaid

☐ **Disassembler** on cassette tape takes machine code programs and produces assembly language source listings to help you understand and improve your programs **$19.95** on cassette tape

SAVE $9.90—Text Editor, Assembler & Disassembler purchased together, only **$49.95!** (Require Video Display Board plus 4k memory.)

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CIRCLE 4

Personal Computing

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CIRCLE 6

FEEDBACK

Copyright Questions Yield Few Answers

Dear Editor:

I have just purchased a TRS-80 Level II computer, entered my subscription for *Personal Computing* for one year, and have had my first success in seeing one of my own personal programs run after an hour of de-bugging.

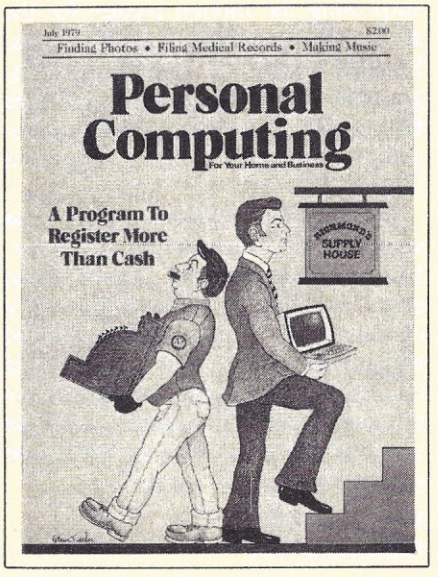
I have a question about the copyright of the programs published. If I modify a published program to suit my needs, how much modification is necessary so that I can claim "my program" as original?

For example, your July '79 issue had a program called "Foto Finder" by Loyd Bulmer. The program as such was not exactly what I was looking for but had a lot of features I could use. I was looking for a file program that would manage my video tape library. With some modifications (and a lot of de-bugging) I came up with a video finder. Now I can show off my new computer and my video recorder at the same time. I have my television programs filed according to kind (movie, series, documentary), type (comedy, horror, science fiction), class (Nova, National Geographic, Wild Kingdom), and cassette number. I have all these programs on three file tapes since I have over 100 video cassettes. Again my question is: in modifying the "Foto Finder" program to suit my needs for my Video Management program, is my program *my program* or do I still have to technically give credit to Mr. Bulmer?

I have also taken a copyrighted mail listing program and modified it to manage my wine cellar. Included in the program was a wine tasting scoring program to evaluate the wines as I drank them.

I realize that I may have come into this hobby so late that the answers to these questions were answered long ago. I would appeciate your answering them again for me.

Robert C. Kyle
Mineapolis, MN



Editor's Note: First note that I'm not a lawyer and can't give legal advice; what follows is only my own personal opinion.

The questions you pose have been bandied about quite a bit, but no one has yet come up with completely satisfactory answers to them. The area of software copyright is still quite new, the laws are vague, and there are few precedents to guide us.

Of course, we publish the programs in the hopes that you will use them; and we realize that many — if not most — readers will want to modify and change programs to suit their particular needs. In the "Foto Finder" article (July *PC*), for example, we pointed out that the program could be modified to handle other collections such as scrapbooks or butterfly collections. In your case, you found an excellent application in organizing your video tapes. We have no objections to you making such modifications for your personal use; in fact, we encourage you to do so.

Problems arise, however, if you intend to distribute a modified program (whether for profit or not). If your modified program remains substantially the same as the published program, you'd be treading on shaky ground to distribute your program. On the other hand, if you've written an entirely new, original program based on *ideas* from a published program, you should be safe.

Consider the case of a copyrighted prose work. You cannot simply change a few words, rearrange a few sentences and modify a few paragraphs — even if you add some original material — and then publish the work as your own. You can, however, use the ideas or facts from a piece of prose in writing an original article. The former is plagiarism; the latter is research.

The rule for prose is that the copyright protects the *form* the author used — his word choice, sentence structure and paragraphs as well as the organization of his ideas. However, ideas and facts themselves are not protected by copyright.

If we extend these rules to software, we see that a copyright should protect the author's expression of the ideas embodied in the program, but clearly not the ideas themselves. Just as it's possible to write many books and articles on the subject of, say, inventory control, programmers could write (and have written) many inventory control programs without infringing on each other's rights. (Because there are few legal precedents, however, we can't know what rules will ultimately apply to software; the differences between prose material and computer programs may make the rules for software quite different from the rules for prose.)

So the best guide we can offer is common sense and your own conscience. If you feel you'd be infringing on someone's rights to publish a modified program, don't do it. But if you feel confident that the program is an original work by you, then you're probably safe in publishing it.

As I mentioned earlier, this note is only my own personal opinion. How do you — the *PC* readers — feel about software copyrights? At what point would you feel you were infringing on someone else's rights in modifying a program? When would you feel someone was infringing on your rights to a program you wrote? Write to let us know; we'll publish the best and most interesting letters. Our address is Feedback, *Personal Computing*, 1050 Commonwealth Ave., Boston, MA 02215. — *D.W.*

Gerrold Update

Dear Personal Computing People:

So there I was, sitting down to enjoy the August issue of one of my favorite magazines and it falls open to my own face staring back at me. I hadn't realized that the industrious Allan Maurer was going to write me up so graciously. I am surprised and flattered. Thank you.

Since that conversation, I've finally traded in my old dedicated word processor (a Savin 900 with Selectric II terminal) for a North Star Horizon (64K, dual disk drive, double density disks) and an NEC Spinwriter. (Next up: a high-res color video interface.)

It may be that my experience with home computing has been atypical. The entire system has been assembled, programmed and serviced by one company: Pat Lajko's California Digital Engineering (1537 Shenandoah, Los Angeles, CA 90035). The programming has been customized for my particular writing, outlining and note-filing needs. Lajko's Edit-Sort program and formatter (which he plans to market soon under the name "Magic Typewriter") far surpass any other word-processing system I've yet had access to, including Electric Pencil.

Lajko (and associates) also provide a near-24-hour hotline for problems I may encounter (with near-instant fixes if bugs show up). Thus, the near-paralyzing terror of the novice who fears that all that fancy machinery may not work (and no amount of kicking will help) was neatly sidestepped. Because I was able to depend on CDE for total services, I was able to get involved with a more sophisticated and ultimately more powerful system than I would otherwise have dared.

I may also be atypical in that I mastered BASIC in one concentrated week of study. I had feared a college course or two might be necessary. It was nowhere near as terrifying as I had feared programming might be. I'm now learning Pascal. It's probably time to let the world know that programming is fun! Programming, in fact, is its own reward!

More than ever now, I'm convinced that the home computer will be the most important appliance of the next decade and beyond (production and the economy permitting). Computer games will probably become a major new artform, particularly the environment simulating ones — eventually perhaps surpassing the motion picture for the ability to provide exciting adventures. Imagine what a world a skilled programmer and an imaginative science fiction writer could design working together. (I may try to take a crack at it myself.)

Maurer was understating the case when he said I'm optimistic. Actually, I'm wildly enthusiastic. More so than ever. The future is going to be a very exciting time — and it's already started happening. I was going to wax poetic here and say that the home computer is the surfboard with which to ride the wave of the future, but that would be going overboard, so I won't.

David Gerrold
Hollywood, CA

Roots and Branches

Dear Editor:

I bought an APPLE II (6502) last year in the hope that it would bring order out of chaos in the collected documentation I have of several thousand ancestors. I would like to be able to store, file, sort, retrieve and cross-reference genealogical data. I would like to be able to have pedigree, individual and family group printouts as well as indexes. The Mormons have done excellent work, but they use IBM 370s. Some work out of the University of Utah has focused on minis using an excellent soundex code with pointer systems for parents and progeny, but the adaptation to micros is not clear.

I would like to hear from others of a similar interest (it also has relevance to tracing genetic disorders and there are other analogs) so that possibly a network of information could be pooled and shared.

Clifton M. Howard
58 Van Orden Road
Harrington Park, NJ 07640

Editor's note: See our September cover story, "Roots and Branches", which deals specifically with your questions. Your letter arrived *after* our editorial deadline, preventing us from including it in the same issue. — *M.M.*

Billiard Rebound

To the Editor:

In your August issue you published a letter from H. T. White claiming that the computerization of the "stagnant pastime" of chess proves that it is less challenging than billiards. He claims that he has ". . .yet to see a computer that can figure out the geometric complexities of the physics of billiards or pool." Well, I have. Some years ago, before small chess computers came on the market, and perhaps even before adequate experimental chess programs on large computers were publicized, I saw a demonstration of a computerized game of pool. The "player" indicated his chosen position for the "cue" with a stylus and the computer determined how each ball would react. A CRT showed white dots moving across a "table", ricocheting off one another and bouncing off cushions. The illusion was so perfect that, except for the lack of color, it was hard to believe that I wasn't looking down, from a distance, at an actual pool table. At no time did any ball move in a way inconsistent with an actual game of pool. The computer could even vary the laws of physics and produce a "frictionless pool table" on which the balls continued to move without slowing.

Pool is a test of manual dexterity and the players' intuitive sense of distance and angles, not intelligence. Chess continues to be the superior challenge to the human mind, and its computerization is a tribute to the skill of computer designers and programmers, and not to the game's lack of difficulty. Chess computers are in their infancy and are still beaten by superior players; but their improvement will bring computers closer to the human mind.

Marc Colten
Budd Lake, NJ

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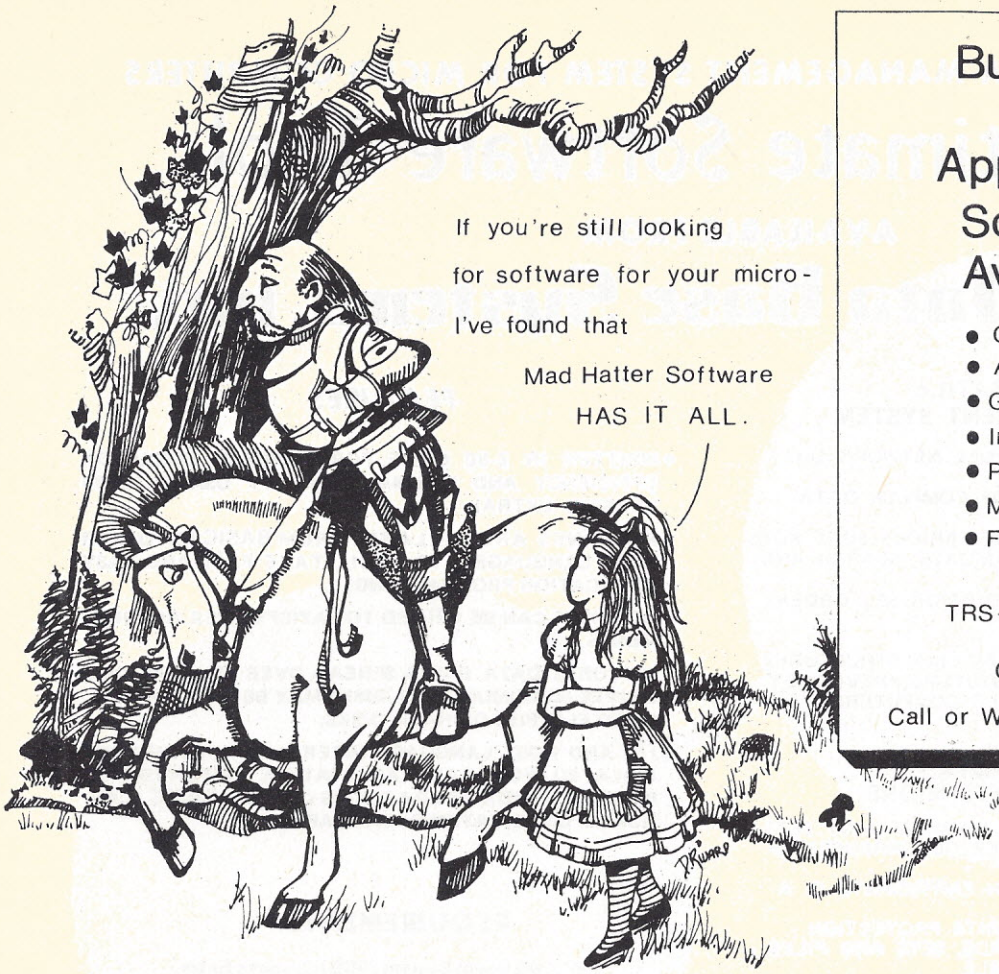

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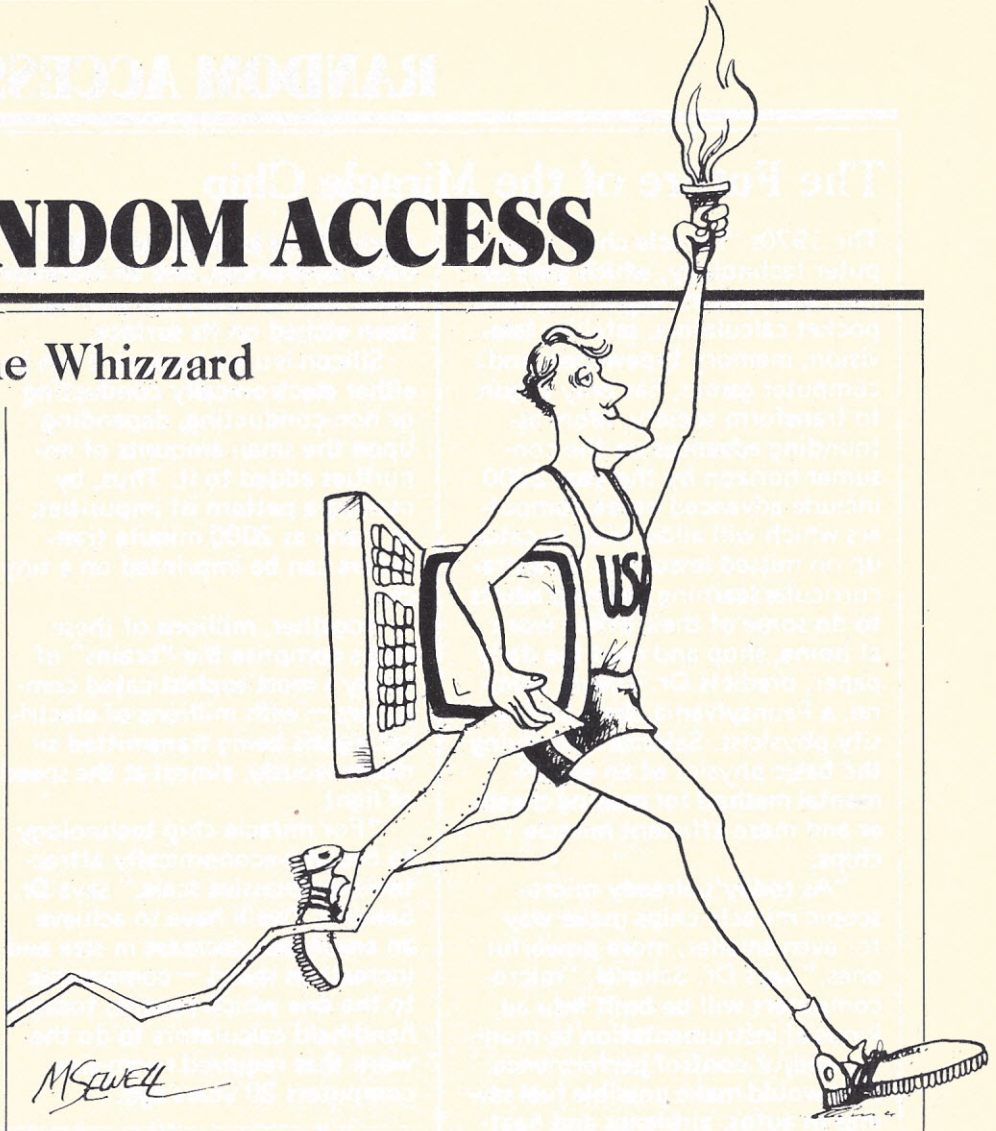
CIRCLE 8

RANDOM ACCESS

A Gold Medal for the Whizzard



Computers may never replace decathalon participants in future Olympics but a new computerized graphics system is helping guide team members toward possible gold medals. Such a computer system was recently donated to the United States Olympic Committee by two companies (Megatek of San Diego, CA, and Data General of Westboro, MA) to help produce better trained athletes. After processing relevant input from Megatek's graphics system, the Data General computer prints out a profile of an athlete's strengths and weaknesses, then makes suggestions for possible improvements in performance. Known as CBA (Computerized Bio-Mechanical Analysis), the program gives coaches an effective method for improving the performance of their athletes and lifting them to higher levels of achievement in future international competition.

The dynamic-body analysis begins by filming the athlete in action. Such a preliminary motion-picture method of observation and criticism is already widely used in many sports. And all have produced good results. But this is the first time that observation and criticism is being done by computer and the results, it is estimated, will be far greater. The CBA method uses high-speed film to record movements of an athlete during actual competition. This film is then developed and every frame is carefully examined by a medical scientist. Prevailing forces at joints (shoulder, upper arm, forearm, wrist, hand and knee) are recorded for subsequent calculation and evaluation by the computer.

A sonic digitizer pen then traces these key body joints and registers them on the Whizzard 7000 graphics screen. Coordinates of points touched by the tracing pen appear on the CRT in the form of stick-like figures. These coordinates are coded and the information is fed into Data General's S/250 computer for processing. Factors such as velocity, acceleration, direction, angle and other forces generated by body movements are then calculated by the computer.

Announcements of both gifts were made at the NCC '79 show in New York, this past June. Both the Megatek Whizzard and the Data General computer will be used by coaches to generate bio-mechanical analyses during training sessions. The computerized guidelines are expected to be of immense help in preparing athletes for international competition, said Colonel F. Don Miller, executive director of the Olympic Committee.

Developer of the CBA program is Dr. Gideon Ariel, who also serves as director of computer science bio-mechanics for the U.S. Olympic Sports Medicine Committee. "Megatek's graphics system and Data General's Eclipse are the keys to our computerized bio-mechanical analysis program," said Dr. Ariel. "Olympic coaches and athletes require such interactive and visual interface between themselves and the computer to see what errors are being made and to determine what techniques can be used to improve performance.

"With the CBA system," continues Dr. Ariel, "Olympic coaches will be able to test out recommended changes in routines before any physical effort is expended by the athlete. Saving of both time and energy will be tremendous and the Olympic Committee is already excited about the future possibilities of helping top athletes achieve their full potential."

— Harry Shershow

Illustration by Mark Sewell

The Future of the Miracle Chip

The 1970s "miracle chip" computer technology, which gave us microcomputers, digital watches, pocket calculators, satellite television, memory typewriters and computer games, has only begun to transform society. More astounding advances on the consumer horizon by the year 2000 include advanced home computers which will allow kids to catch up on missed lessons or do extracurricular learning and help adults to do some of their office work at home, shop and read the daily paper, predicts Dr. Toshio Sakurai, a Pennsylvania State University physicist. Sakurai is studying the basic physics of an experimental method for making cheaper and more efficient miracle chips.

"As today's already microscopic miracle chips make way for even smaller, more powerful ones," says Dr. Sakurai, "microcomputers will be built into all kinds of instrumentation to monitor and/or control performance. This would make possible fuel savings in autos, airplanes and heating furnaces; and warnings when mechanisms, such as car brakes, are about to malfunction."

Using a "magnetic-sector, atom-probe field ion microscope," which he and his mentor, the late Dr. Erwin Mueller, invented in 1973, Dr. Sakurai and his students have learned that the potential already exists for manufacturing miracle chips up to 1000 times faster, and therefore far less expensively, than is done now.

With a grant from the Research Corporation of New York, a private foundation which finances university research, Dr. Sakurai's group is studying how to use an ionized beam of the mercury-like, semi-metal gallium to make miracle chips.

Essentially a miracle chip is a fleck of pure silicon, the main component of sand, and, next to oxygen, the most abundant element on earth. Currently as tiny as one-tenth of an inch in diameter and one-hundredth of an inch thick, it has been coated with other substances, and an intricate electronic circuitry pattern has been etched on its surface.

Silicon is used because it can be either electronically conducting or non-conducting, depending upon the small amounts of impurities added to it. Thus, by making a pattern of impurities, as many as 2000 minute transistors can be imprinted on a tiny chip.

Together, millions of these chips comprise the "brains" of today's most sophisticated computers — with millions of electrical signals being transmitted simultaneously, almost at the speed of light.

"For miracle chip technology to become economically attractive on a massive scale," says Dr. Sakurai, "we'll have to achieve an enormous decrease in size and increase in speed — comparable to the one which permits today's hand-held calculators to do the work that required room-size computers 20 years ago."

The problem, Dr. Sakurai explains, is that the chip size is limited by how narrow the etched pattern slits can be made; and the slit size is limited by the wavelength and intensity of the etching beam.

"To make the original computer circuits," says Dr. Sakurai, "an ultraviolet (UV) light beam was used, because this was the conventional tool for photo-lithography."

However, UV light limits how small and clear the etching can be made. The miracle chip resulted from a switch to an electron beam. This method improved the clarity and speed of the etching because an electron beam has a shorter wavelength. Also, it's faster and more intense, and can be more finely focused.

By switching again, this time to an ion beam, Dr. Sakurai says, miracle chips can be made much smaller, faster, more efficient and cheaper — because an ion beam is far more intense and faster than an electron beam.

It is the size of these already microscopic insulating and con-

THEY WOULD HAVE BEEN A LOT EASIER TO DISSEMINATE IF YOU HAD GIVEN THEM TO ME ON TAPE!

ducting parts that is at issue. These must be made far smaller to decrease the size of the chips and to increase the speed and hence efficiency of the chips.

"We found," says Dr. Sakurai, "that a gallium beam improves focusing and therefore circuit clarity about 50 times and etching speed about 1000 times. Because the cost of making computer chips is inversely proportional to the speed, a gallium ion beam has great potential for further revolutionizing computer technology.

"In the meantime, more must be learned about the gallium ionization process and its use as an etching tool before it's possible to design and construct the type of highly complicated and expensive equipment needed to make the next computer revolution a reality."

Computers Go to Court

Prosecution of criminal cases involves costly and time-consuming procedures for local governments. But in Contra Costa County, California, where court activity has increased 40 percent in the last year, a computerized court management system has stabilized costs and made more information available more quickly to court officials.

According to Tom Falce, County Director of the Law and Justice Systems Development Project, the county has taken its first step in the development of a distributed data processing network of computers to manage the entire criminal justice system.

Minicomputer systems in each of the county's four lower courts are processing the collection of parking citation fines and preparing schedules of court resources and activities.

Contra Costa County incorporates 13 cities and is California's eighth largest county, with a population of 600,000. The area endures a heavy volume of traffic; and in recent years the rising incidence of illegal parking has been one of the local government's major concerns. In the city of Walnut Creek, for example, 50,000 parking tickets were issued last year.

The county's lower courts are responsible for collecting parking and other traffic violation fines as well as arbitrating these infractions, if challenged; mediating misdemeanors like petty theft or drunk driving; and conducting preliminary hearings for felonies like rape, murder and armed robbery.

Each of the county's lower courts employs a staff to process the collection of fines and to schedule court activities. Prior to computerization, these tasks were performed manually; but employees had trouble keeping up with an increasing workload.

To expedite the flow of information among the county's criminal justice departments, the county formed the Justice Automation Advisory Committee to investigate automation as an alternative method to manual operations.

The committee concluded that automation was the most efficient and economical solution to the problem.

An IBM 370/158 mainframe computer in the county's central data processing facility in Martinez was performing a number of county functions like processing the payroll, maintaining welfare records, and calculating property taxes. But this computer was operating in a batch mode, which produced delays between data entry and processing. The county needed a different kind of computer system — one that could capture data at the source, could be operated easily, and could provide ready answers to questions.

The staff selected Data General computer systems with 32K core memory, 10 megabyte disks, three Dasher display terminals and medium-speed printers, which were all installed in the first of the four lower courts in November 1977. Application software was written in Interactive COBOL.

The systems were operational in the pilot court in the spring of 1978 and system impelementation in the other courts began.

"The computers are managing the whole parking system here," Falce said, "which is really a high-volume, accounts receivable type of application." Administrative personnel at each court enter citation data into the computer, which determines if the violation is legitimate, calculates the bail or fine and later records payment and subsequent court actions.

The computer also records nonstandard or exceptional violations — those committed by persons with out-of-state registrations, multiple violations, and so forth.

The criminal calendar application schedules the activities in the courtrooms as well as the resources available and reports the actions taken by the court on the cases scheduled. This function essentially designates the who, what, when, where and why of a particular case and prepares an agenda. What, when, where and why are easily determined; but any number of individuals, in addition to attorneys, may be asked to attend a hearing, such as the probation officer or law enforcement officer.

These case details are input to the systems, the agenda is compiled and reports are generated on the system printers and distributed to the parties involved. Case data from individual courts is also examined at this time to determine if a defendant has any other offenses pending in another court in the county. "The criminal calendar is very important," Falce said. "because it is absolutely critical that all agencies are aware of the court agenda." Each of these agencies schedules its activity and resources around this agenda, so coordination and accuracy are essential.

"This is only the first step in a series of computer installations

for the whole criminal justice system. In the next six months we expect to double both system memory and disk space. And we want to add a third application to process moving traffic violations as soon as possible.

"We plan to expand even further within the next two years, adding processors to perform case tracking for the district attorney, bookings and jail management for the sheriff, case management for the probation office, case tracking for the public defender and calendar and jury management for the superior court," said Falce. "Our goal is to tie all these applications together into a distributed processing network in the county. Information will be captured at the source, in the functional work flow, and passed via the network to each agency as it gets involved with the case. The efficiencies and accuracy of this system will be a tremendous boost to the operation of the criminal justice system."

Dr. Nicholson's Magic Dental Charts

Dr. J.H. Nicholson, a dentist in Dallas, Texas, recently bought a personal computer to help out with office management functions such as payroll, billing and supply records.

With those routine programs easily accomplished, the enterprising doctor turned to his Apple II to help him bring patients back to his office on schedule. Now he's going a step further and devising a program to help make those office visits a little less intimidating.

Dr. Nicholson previously used a manual patient reminder system, but early this year he decided to check out the effectiveness of the system and was astounded by the results. In 1978 alone, a flaw in the system dropped over 90 patients from the recall process. Until then, he had assumed these patients either ignored their six-month reminder notices or had taken their business to another dentist.

The Apple II was programmed to see that reminder notices were mailed on time, and a follow-up mailing to those 90 "lost" patients produced new appointments for over 80 percent of them.

The greatest challenge for the system lies ahead, however. Dr. Nicholson and a software specialist are now devising a high-resolution graphics system on the Apple II. They hope it will lessen the anxiety caused by the nation's most disagreeable chore — visiting the dentist.

When fully operable, the system will enable Little Johnny to see a depiction of the "ideal" mouth with molars, bicuspids, incisors and the like lined up in perfect curvature.

The Apple will then show Little Johnny his own mouth — less than perfect but still his — adding cavities, fillings, bridgework and extractions, all color-coded to help the dentist explain what has been done, what needs to be done, and, hopefully, why it won't hurt a bit.

Admittedly, the graphics can't numb the pain. Dr. Nicholson believes, however, that they can help the patient to relax.

"The visual picture will be something they can relate to," he explained. "It should help put them at ease. At the very least, it is sure to get their attention.

"You mention the magic word 'computer,' put their chart on the screen, and they're going to watch, listen and, if they have any questions, ask them."

Dr. Nicholson and his "magic dental charts" may well become a hard act for other dentists to follow.

Reprinted from Apple Magazine, *Volume 1, Issue 2, by permission of Apple Computer, Inc., Cupertino, CA.*

Carpools and Computers

CarShare carpooling information system is Houston's attempt to save gas through computer use.

The Metropolitan Transit Authority (METRO) of Houston and Harris County recently unveiled their newly computerized system, which was designed and developed by Contemporary Communications Corporation of Houston and uses computers from Datapoint Corporation of San Antonio.

When a phone call is received from a CarShare candidate, data concerning the person's name, work address, home and work phone numbers, work days, work time and whether the request is to share their vehicle or to ride is entered into the computer. The system accommodates those who own a vehicle and wish to both drive and share, those who only want to share a ride and those who do not own a vehicle but would like to join a carpool.

The computer provides an instant search of the CarShare files. Data from all prior candidates within the files is arranged to show who lives within 3 miles and works within 1.5 miles of the requester. The file search can be extended to also indicate adjoining areas or to other candidates who live along the requester's most probable route to work.

The information is displayed on the computer's screen and simultaneously a letter of reply concerning the CarShare request is produced on an attached printer for mailing to the candidate.

Because of EPA requirements concerning employee ride sharing, large businesses in the Houston area have begun to pay special attention to CarShare. Several are interested in placing video terminals in their own offices for direct tele-communications with the METRO system, which is currently matching 75 to 80 percent of the would-be carpoolers requesting its services.

"World of Tomorrow" Theme Featured at Personal and Business Computer Show

See the computerized world of tomorrow . . . today, at the Northeast Personal & Business Computer Show, Boston Hynes Auditorium, September 28 to 30.

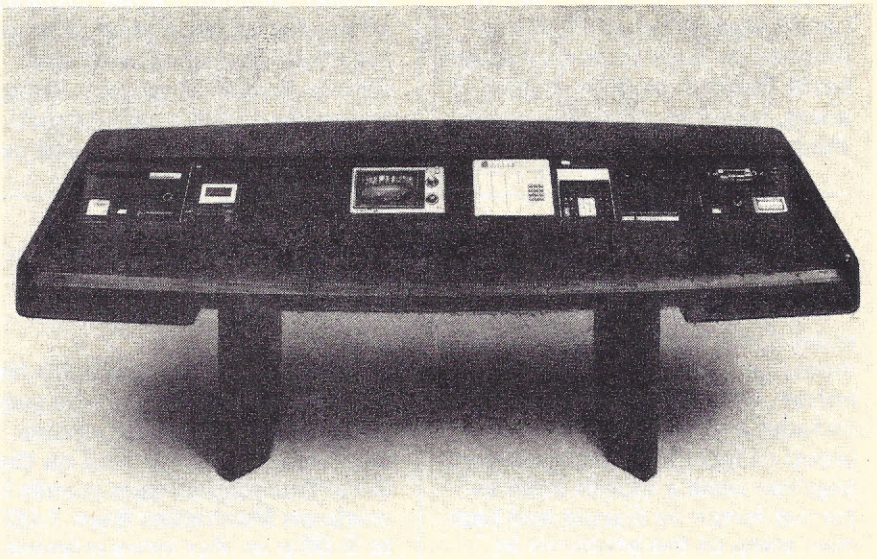
Hundreds of manufacturers, distributors and retailers will showcase their new 1980 micro, mini and small computer systems. Companies exhibiting include Radio Shack, Commodore, RCA, Compucolor, Texas Instruments, Heathkit and Burroughs, said show officials.

Personal computerists will be able to meet and talk with major terminal and peripheral company representatives, plus software developers, magazine editors and book publishers. The enthusiast will see computer art, graphics and animation, hear computer synthesized music, watch computerized amusements, play electronic and video games and attend free tech talks and briefings given by internationally recognized speakers.

Computerists interested in business systems will find small and medium-sized systems at the show. Attendees will hear clear, non-intimidating and non-technical explanations of how businessmen and professionals are using today's technology to increase productivity and profits, yet decrease their work load, officials said.

On view will be office automation, business software, and information systems. Many of the exhibitors will be catering to people interested in starting their own computer business, or changing their job in the computer industry.

The businessman who thinks he has everything will realize he doesn't when he sees the Zell Electronic Executive Desk. The desk sells for $15,000 and comes complete with a color TV with UHF and VHF receiver, a closed circuit TV monitor with two or more cameras and a display terminal for the executive's mini-computer, which is also built into the desk. Other built-in gadgets include an audio cassette recorder and player which is part of the desk's stereo sound equipment, a video player and recorder, custom remote operated telephones with speakers, an automatic paper copier, a paper shredder, an electronic telephone index, an automatic pencil sharpener, a dictating transcriber, a printing adding machine and a calculator.



Zell Executive Desk resembles combination auto instrument panel and NASA control center.

In addition, there's an electrical height adjustment which raises the desk for standup use. The desk comes in black walnut, teak, rosewood, or elm burl — and if your favorite gadget is missing from the above list, the manufacturer will be happy to build it into your custom unit.

The show is offering an $18,000 computer as a door prize.

For more information contact Jane Badgers and Company, 75 McCarthy Road, Newton, MA 02159; (617) 244-5305; (617) 523-5563.

Office Appliances and Communications

Within the next ten years, you'll not only be using your telephone to make business calls, but to exchange messages and retrieve data stored in computer banks as well, according to an Arthur D. Little study. And, while your conventional copying machine will still duplicate documents, it will also serve as a facsimilie communications terminal and as a printer for typewriters and computers linked to it.

Arthur D. Little, Inc., the international research and management consulting firm, which has just completed a study of the growing influence of microprocessor technology, cites these as examples of the way office equipment of today will evolve into microprocessor-controlled multipurpose office appliances. After 1987, says Frederic G. Withington, a computer industry expert who led the business communications portion of the study, larger and more advanced companies will begin to link these "hybrid" products with one another to form total office systems.

The study forecasts that value of shipments for business communications equipment in four

countries — the United States, United Kingdom, France and West Germany — will rise from $9.3 billion in 1977 to as much as $23 billion in 1987. That increase, says Withington, is constrained by such factors as added costs. Few information appliances, he notes, actually reduce the cost of office operations; rather, they improve communications and save time.

Conflicting government requirements and the need for improved common carrier systems to handle sophisticated communications equipment will also constrain market growth. Then, too, there is still a lack of software that can be understood by the ordinary office worker as well as the trained technician.

Despite these constraints, says Withington, the future will see intense competition among companies and national interests. A flood of novel product offerings will become available. In general, he says, there will be a chaotic but richly dynamic market.

☆☆☆ Announcements ☆☆☆

The Sacramento Micro Computer Users Group (SMUG) promotes personal computers as a hobby. Club membership (150+) includes a loosely structured group of local hobbyists who get together once a month in an informal forum to discuss and hash over some of the problems in personal computing. A monthly newsletter, "Push & Pop", contains information and ads from local commercialists. Members receive group discounts on magazine subscriptions, electronic components and hardware and software systems. Meetings are held every fourth Tuesday of every month this year (except December 18, 1979) at the SMUG Training Building on 59th Street, between Highway 50 and Folsom Boulevard. Contact SMUG, P.O. Box 161513, Sacramento, CA 95816.

The Pima Community College Computer Club (PC↑4) has been formed at the East Side campus, 7830 East Broadway, and meets the second Friday of each month at 7:30 p.m. Most members have already purchased systems, but those still searching for the best buy are welcome, as are non-students. Several system demonstrations have been held and more are planned. Contact Mike Blicharz at (602) 749-9157 or Saul Levy at (602) 793-0670.

The Micro-Computer Business Users Group (BUG) now publishes a monthly newsletter, offering BUG members exchange of software evaluations, criticisms, ideas and advice. There is a charge of $10 for the newsletter for 1979.

Group meetings, generally free and informal, often include guest speakers and panel discussions. Meetings are usually held on the third Thursday of each month in midtown Manhattan from 7:00 to 9:00 p.m. Fcr more information contact Micro-Computer Business Users Group, 161 W. 75th St., New York, NY 10023. (212) 580-3589.

The Delmarva Computer Club, a general interest club, meets at Arcadia High School in Oak Hall, VA, at 7:30 p.m. on the first and third Wednesday of each month.

Beginners are able to get hand hands-on programming instruction in BASIC language. Advanced members work on community projects and software development and exchange. For further information contact Jean Trafford, Secretary, Delmarva Computer Club, P.O. Box 36, Wallops Island, VA 23337; (804) 824-3400 after 5:15 p.m.

The new Solano TRS-80 User's Club of Fairfield, CA, holds meetings every third Thursday at Owens-Illiois, 2500 Huntington Drive. For more information contact Dave or Steve Irwin at 550 Marigold Drive, Fairfield, CA 94533; (707) 422-3347.

Shoppers for computers in the Southern California area can use a new service implemented by the Southern California Computer Dealers Association.

Until now, computer customers relied on magazines and the Yellow Pages for store locations. Now everyone from San Diego to Santa Barbara may dial a toll free number, (800) 432-7257, and reach the Consumer Computer Information Service. The answering voice (not a computer) will ask for the caller's city; then the caller will be given the names, addresses and phone numbers of the three nearest computer stores.

Washington Area Kim Enthusiasts meet each month at the McGraw-Hill Continuing Education Center in Washington, DC, to study operation, expansion and applications of KIM-1 microcomputers. Meetings are at 7:30 p.m. on the third Wednesday of every month.

For more information contact WAKE, c/o Ted Beach, 5112 Williamsburg Boulevard, Arlington, VA 22207; (703) 538-2303.

A task force of the ACM subcommittee on Elementary and Secondary Schools has assembled a set of materials on programming contests. Designed to aid high schools, colleges and individuals in planning high school programming contests, the material is geared to team contests but can be adapted to individual competitions. The packet includes suggested rules, sample problems, references and solutions. For more information, contact Dale Bryson, Mathematics Dept., Umpqua Community College, P.O. Box 967, Roseburg, OR 97479; or R. Waldo Roth, Chairman, Dept. of Computer Science, Taylor University, Upland, IN 46989; (317) 998-2751 ext. 269.

TRS-80 owners LOOK

at these Programs!!! (and these prices!!)

Graphic Drawing Done On The TRS80 Using "The Electric Artist" Program!

GRAPHIC-TREK "2000" This full graphics, real time game is full of fast, exciting action! Exploding photon torpedoes and phasers fill the screen! You must actually navigate the enterprize to dock with the giant space stations as well as to avoid klingon torpedoes! Has shields, galactic memory readout, damage reports, long range sensors, etc! Has 3 levels for beginning, average, or expert players!

INVASION WORG Time: 2099 Place: Earth's Solar System Mission: As general of earths forces, your job is to stop the Worg invasion and destroy their outposts on mars, venus, saturn, neptune, etc! Earth's Forces: Androids — Space Fighters — Lazer Cannon — Nuetrino Blasters! Worg Forces: Robots — Saucers — Disintegraters — Proton Destroyers! Multi level game lets you advance to more complicated game as you get better!

STAR WARS Manuever your space fighter deep into the nucleus of the Death Star! Drop your bomb then escape via the only escape route. This graphics game is really fun! May the force be with you!

SPACE TARGET Shoot at enemy ships with your lazer gun. If they eject in a lifeboat vehicle, capture them, or if your cruel, destroy them! Full graphics, real time game!

SAUCERS This fast action graphics game, has a time limit! Can you be the commander to win the distinguished cross! Requires split second timing to win! Watch out! The saucers fight back!

Package One — $12.95

CHECKERS 2.1 Finally! A checkers program that will challenge everyone! Expert as well as amateur! Uses 3-ply tree search to find best possible move. Picks randomly between equal moves to assure you of never having identical games. Computer also makes sly remarks about the game!

POKER FACE The computer uses psychology as well as logic to try and beat you at poker. Cards are displayed using TRS-80's full graphics. Computer raises, calls, and sometimes even folds! Great practice for your Saturday night poker match!

PSYCHIC Tell the computer a little about yourself and he'll predict things about you, you won't believe! A real mind bender! Great amusement for party's.

TANGLE MANIA Try and force your opponent into an immobile position. But watch out, their doing the same to you! This graphics game is for 2 people and has been used to end stupid arguments. (And occasionally starts them!)

WORD SCRAMBLE This game is for two or more people. One person inputs a word to the computer while the others look away. The computer scrambles word then keeps track of wrong guesses. Can you make less mistakes then your adversary?

Package Two — $12.95

POETRY This exciting and sometimes funny program lets you choose the subject as well as the mood of the poem you want. You give TRS-80 certain nouns or names, then mood, and he does the rest! TRS-80 will write different poetry about one subject forever if you let him. Has a 1000 word + vocabulary of nouns, verbs, adjectives, adverbs!

ELECTRIC ARTIST Written by a working artist and a computer engineer to make drawing on the video screen easier then picking up a pencil! (Less messy too!) Manual: Draw, erase, move as well as, Auto: Draw, erase, move. Uses graphics bit's not bytes. Graphic face in ad done using this ingenius program!

GALACTIC BATTLE The Swineus enemy have long range phasers but cannot travel at warp speed! You can, but only have short range phasers! Can you blitzkrieg the enemy without getting destroyed! Full graphics — real time!

WORD MANIA Can you guess the computers words using your human intuitive and logical abilities? You'll need to, to beat the computer! He keeps score and gets mad if he loses!

AIR COMMAND Real time, graphics Flight Simulater! Land, take-off, get out of a spin! Be careful not to stall! Watch your fuel gauge! Requires a clear headed pilot.

Package Three — $12.95

LIFE This Z-80 machine language program uses full graphics! Over 100 generations per minute make it truly animated! You make your starting pattern, computer does the rest! Program can be stopped and changes made! Watch it grow!

REAL TIME LANDER This full graphics simulater lets you pick what planet, asteroid or moon you wish to land on! The "Live" keyboard gives super response that gives you the feeling of being in command! Has 3 skill levels that make it fun for everyone.

GREED II Multi-level game is fun and challenging! Beat the computer at this dice game using your knowledge of odds and luck! Computer keeps track of his winnings and yours. Quick fast action. This game is not easy!

THE PHARAOH Rule the ancient city of Alexandra! Buy or sell land. Keep your people from revolting! Stop the rampaging rats and locusts'. Requires a true political personality to become good!

ROBOT HUNTER A group of renegade robots have escaped and are spotted in an old ghosttown on mars! Your job as "Robot Hunter" is to destroy the pirate machines before they kill any more settlers! Exciting! Challenging! Full graphics!

Package Four — $12.95

SUPER HORSERACE! Make your bets just like at the real racetrack! 8 horses race in this spectacular graphic display! Up to 9 people can play! Use's real odds but has that element of choice you see in real life! Keeps track of everyone's winnings and losings. This is one of the few computer simulations that can actually get a room of people cheering!

MAZE MOUSE The mouse with a mind! Computer generates random mazes of whatever size you specify then searches for way out! The second time thru he'll always go fastest route! A true display of artificial intelligence! Full graphics, mazes & mouse!

AMOEBA KILLER You command a one man submarine that has been shrunken to the size of bacteria in this exciting graphic adventure! Injected into the presidents bloodstream, your mission is to destroy the deadly amoeba infection rampaging his body!

LOGIC This popular game is based on mastermind but utilizes tactics that make it more exciting and challenging! Has 2 levels of play to make it fun for everyone.

SUBMARINER Shoot torpedoes at the enemy ships to get points. Fast action graphics, arcade type game is exciting and fun for everybody!

Package Five — $12.95

20 HOME FINANCIAL PROGRAMS Did you ever get a loan and wonder if they figured interest or payments correctly? Or did you ever want to see what your payments would be if you borrowed x amount at x% interest over x years! Figures amortization, anuitys, depreciation rates, interest tables, earned interest on savings and much, much more. This program will get used again and again. A must for the conscientious, inflation minded person.

Package Six — $12.95

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CIRCLE 9

On Languages

BY WILLIAM R. PARKS

Today, more than 100 computer languages are in use by programmers to communicate instructions or commands from the keyboard to a computer. Internally, Assembly and Machine level languages are used to program the operating systems of computers.

The most popular high level languages are: COBOL for business applications; FORTRAN for scientific work; BASIC for home, hobby, and small business computers; and PASCAL for teaching programming to college students. All of these languages, except Assembly and Machine language, use special English words and simple mathematical notations to express commands for actions to be taken within a computer system.

The high-level languages, such as BASIC or COBOL must first be translated into low-level machine codes before the computer can understand the commands. A high-level statement such as "C = B + A", when translated, appears in machine level code as a string of bits and bytes: "10110010000110100101000101001 1101010100 . . . ." Translators accomplish these tasks. Translators are programs stored within computers to convert high-level code to machine language.

Which of the present day languages will persist in the future? What changes will take place? What, if any, new languages will evolve? Those are the most popular questions among computer scientists. We should first make a clear distinction among several broad categories of use for computer programming languages: 1) Some languages are primarily used to program a computer's operating system. 2) Other languages are used for business or scientific applications (payroll, accounting, math problems). 3) A third category of languages is used to manipulate large or small data bases; that is, retrieve records, update files, and carry out procedures for generating new information from existing files.

In the first category (for operating systems) we see today three predominant languages: PASCAL, Assembly, and Machine languages. Those languages are frequently used to code programs which constitute the computer's main operating system. The operating system is really only a set of programs that comes with a computer. For example, when you purchase a home computer today you get an operating system, as part of the purchase price, which is permanently stored somewhere in the computer's memory. In the past, most operating systems have been written in Assembly. However, I believe that PASCAL is destined to become the predominant language for future programming operating systems. Assembly and Machine language may still be used in parts of the operating system. However, these lower level codes will become much less important than they are today.

Will 'STRUCTURED ENGLISH CODE" emerge out of the morass as the main language of the future?

If PASCAL does become the most important operating system language in the future, several significant things will happen: 1) The dedicated hobbyist will be able to rewrite or even create his own operating system. 2) The beginning student of programming will quickly learn how the computer's system operates. By contrast, today most operating system programs are difficult to understand even by professional programmers. Machine language and Assembly language are low level codes which are hard to use and document. Usually the original author of the low-level programs is the only one who seems to know what's going on. And he, too, soon forgets the complex coding with the passage of time. 3) One spectacular result of switching to PASCAL will be that operating systems will become more responsive to the needs of the computer user. It will be possible to have the most complex operating systems (found only in the biggest computers today) resident in small home computers at a very small fraction of the development cost. During the recent NCC show in New York, as a matter of fact, Apple computer company displayed the first personal computer to use PASCAL. That is a significant step forward.

Easy dialogue between computer and man will be the main feature of such a future language. Programs will be written with the aid of the computer. Human voice input and computer voice output will generate whole sections of program code in the English-like language of the future. The roots of that language are already here in BASIC, and some are in the characteristics of PASCAL.

The third main use of computer languages instructs a computer to retrieve information from large data bases. The languages currently used for manipulating these large data bases are often not even considered bona fide languages by programmers. The name for such a language is "QUERY". QUERY allows you to use English sentences to interrogate a computer's data base. With QUERY you can access any record or any item within a record. As this language for retrieving information evolves, it might someday be possible to speak in "street" English to extract information from large data bases. In the future, QUERY could easily become a standardized language that all children will learn in school. They will use it to speak to computers for the purpose of acquiring knowledge on any subject stored in a data base. These data bases will hold more information than the largest libraries now in the world. An interrogative language like QUERY could quickly retrieve all kinds of information (programs,

games, learning systems, news, entertainment) without requiring any knowledge of programming on the part of the user. This is already being done on a limited scale as non-programmers now prepare lists of procedures to be done with certain records and files in the database.

As described above, the languages used in each of these three main areas of programming are not necessarily the same. Distinctions among the different areas will continue into the future. However, the languages used in each area will continue to evolve in their own channels. To some extent, the above predictions of language developments are already taking place in some form. And, it is only a matter of time before all the mentioned possibilities become realities!

The second main use of computer languages is for applications in business (payroll, billing, ordering), in the home (games, education, finance), in industry (production planning, research). Big business today writes most of its application programs in COBOL. Small business computer users rely more on BASIC and extended versions of BASIC. Which language will predominate in the future? The leaning seems to be in the direction of some version of BASIC! As a matter of fact, a recent school survey has shown that BASIC has overtaken FORTRAN in the past year. BASIC is becoming more popular while FORTRAN seems to grow less popular. Will COBOL go the same route as FORTRAN? In the past, COBOL had been used so extensively by industry that it will rank as a main application language for some time.

But I still think that a future version of BASIC will ultimately win the race for popularity. Perhaps it will combine the best features of PASCAL and the BASIC that is in use today. A convenient name for this future language could be: "STRUCTURED ENGLISH CODE"! At this time, I predict that "structured English" will be the future language of computers. Furthermore, as computer memories become very large (100 megabytes) and wordlengths increase to 32 bits in home computers, we may even eliminate the word "structured" and refer to the future computer language as being ordinary ENGLISH — a subset of our native tongue!

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Explorer/85's Level "A" system features the advanced Intel 8085 cpu, an 8355 ROM with 2k deluxe monitor/operating system, and an 8155 ROM-I/O—all on a single motherboard with room for RAM/ROM/PROM/EPROM and S-100 expansion, *plus* generous prototyping space.

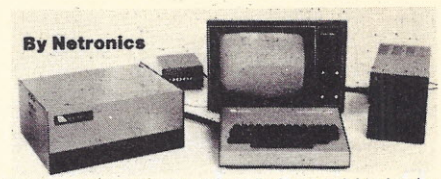
(Level "A" makes a perfect OEM controller for industrial applications and is available in a special Hex Version which can be programmed using the Netronics Hex Keypad/Display.)

Level "A" at $129.95 is a complete operating system, perfect for beginners, hobbiests, or industrial controller use.

PC Board: glass epoxy, plated through holes with solder mask • **I/O:** provisions for 25-pin (DB25) connector for terminal serial I/O, which can also support a paper tape reader ...provision for 24-pin DIP socket for hex keyboard/display...cassette tape recorder input...cassette tape recorder output...cassette tape control output...speaker output... LED output indicator on SOD (serial output) line...printer interface (less drivers)...total of four 8-bit plus one 6-bit I/O ports • **Crystal Frequency:** 6.144 MHz • **Control Switches:** reset and user (RST 7.5) interrupt...additional provisions for RST 5.5, 6.5 and TRAP interrupts onboard • **Counter/Timer:** programmable, 14-bit binary • **System RAM:** 256 bytes located at F8ØØ, ideal for smaller systems and for use as an isolated stack area in expanded systems...RAM expandable to 64k via S-100 bus or 4K on motherboard.

System Monitor (Terminal Version): 2k bytes of deluxe system monitor ROM located at FØØØ leaving ØØØØ free for user RAM/ROM. Features include tape load with labeling ...tape dump with labeling...examine/change contents of memory ...insert data...warm start...examine and change all registers...single step with register display at each break point, a debugging/training feature...go to execution address... move blocks of memory from one location to another...fill blocks of memory with a constant...display blocks of memory ...automatic baud rate selection...variable display line length control (1-255 characters/line)...channelized I/O monitor routine with 8-bit parallel output for high speed printer... serial console in and console out channel so that monitor can communicate with I/O ports.

System Monitor (Hex Version): Tape load with labeling... tape dump with labeling...examine/change contents of memory...insert data...warm start...examine and change all registers...single step with register display at each break point ...go to execution address. Level "A" in the *Hex Version* makes a perfect controller for industrial applications and can be programmed using the Netronics Hex Keypad/Display.



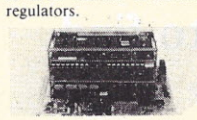
Hex Keypad/Display.

Hex Keypad/Display Specifications

Calculator type keypad with 24 system defined and 16 user defined keys. 6 digit calculator type display which displays full address plus data as well as register and status information.

Level "B" Specifications

Level"B" provides the S-100 signals plus buffers/drivers to support up to six S-100 bus boards and includes: address decoding for onboard 4k RAM expansion select-able in 4k blocks...address decoding for onboard 8k EPROM expansion selectable in 8k blocks...address and data bus drivers for onboard expansion...wait state generator (jumper selectable), to allow the use of slower memories...two separate 5 volt regulators.



Explorer/85 with 1 of "C" card cage.

Level "C" Specifications

Level "C" expands Explorer's motherboard with a card cage, allowing you to plug up to six S-100 cards directly into the motherboard. Both cage and cards are neatly contained inside Explorer's deluxe steel cabinet. Level "C" includes a sheet metal superstructure, a 5-card gold plated S-100 extension PC board which plugs into the motherboard. Just add required number of S-100 connectors

Level "D" Specifications

Level "D" provides 4k or RAM, power supply regulation, filtering decoupling components and sockets to expand your Explorer/85 memory to 4k (plus the original 256 bytes located in the 8155A). The static RAM can be located anywhere from ØØØØ to EFFF in 4k blocks.

Level "E" Specifications

Level "E" adds sockets for 8k of EPROM to use the popular Intel 2716 or the TI 2516. It includes all sockets, power supply regulator, heat sink, filtering and decoupling components. Sockets may also be used for soon to be available RAM IC's (allowing for up to 12k of onboard RAM).

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☐ **8k Microsoft BASIC** on cassette tape, **$64.95** postpaid.

☐ **8k Microsoft BASIC in ROM Kit** (requires Levels "B," "D," and "E"), **$99.95** plus $2 p&h.

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☐ **Deluxe Steel Cabinet** for Explorer/85, **$49.95** plus $3 p&h.

☐ **ASCII Keyboard/Computer Terminal Kit** (features a full 128 character set, upper & lower case, full cursor control, 75 ohm video output convertible to baudot output, selectable baud rate, RS232-C or 20 ma. I/O, 32 or 64 character by 16 line formats, and can be used with either a CRT monitor or a TV set (if you have an RF modulator), **$149.95** plus $2.50 p&h.

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☐ **48K RAM Kit, $459.95** plus $2 p&h.

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☐ **16k RAM Expansion Kit** (to expand any of the above up to 64k), **$139.95** plus $2 p&h each.

☐ **Intel 8085 cpu User's Manual, $7.50** postpaid.

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(Bank # _ _ _ _)
Acct. # _____
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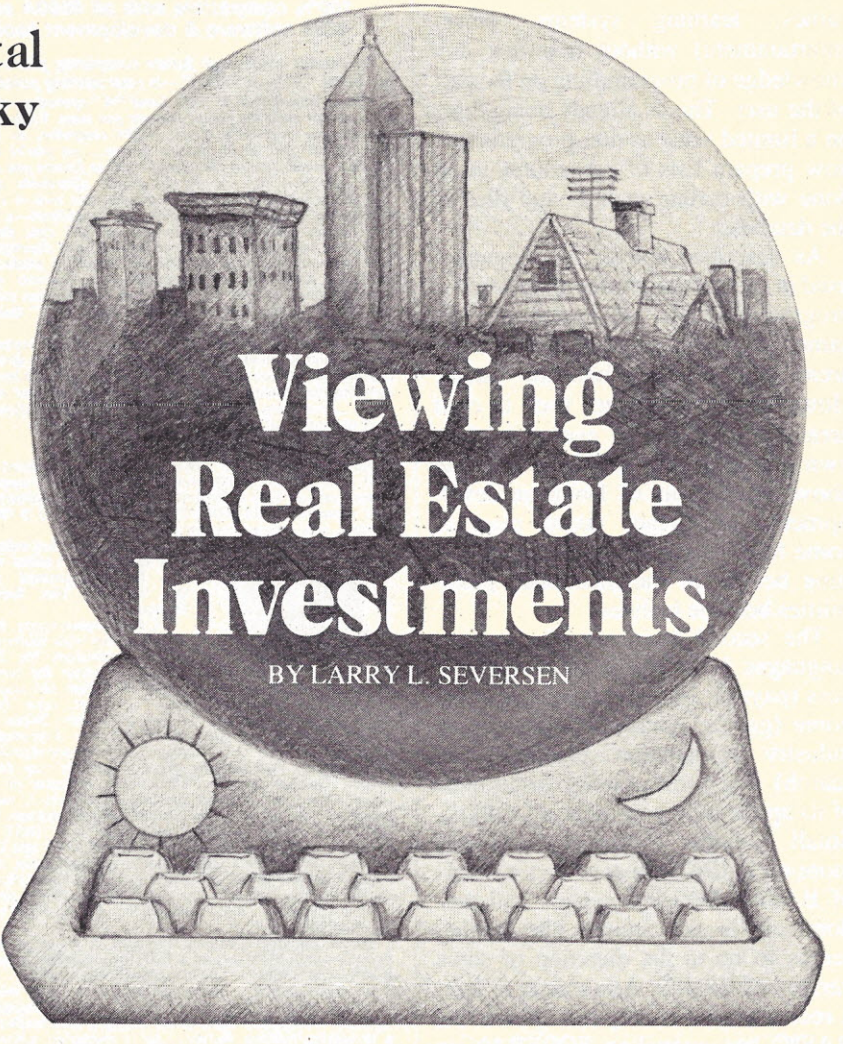
☐ **Send Me Information**

CIRCLE 10

Buying a home or rental property involves tricky calculations to insure you're getting a good investment. Here is a program that will allow you to find out exactly what the cost and benefits of a specific rental property are.



Viewing Real Estate Investments

BY LARRY L. SEVERSEN

This program will give you an easy way to sum up any real estate purchase. The input facts that make the program accurate are readily available and can save you thousands of dollars.

You can modify the program for owner-occupied homes by removing depreciation and expenses from the program, shown by D1, H and M. The idea for this expanded program came from Kimball Beasley's article, "Income Property Evaluation" (*PC*, January 1979).

North Star BASIC was used with a disk system for the program which was saved on 13 blocks. There are a few valid and legitimate assumptions and limitations to the program:

- Only accelerated depreciation
- Interest rate constant
- All escrow costs are deductable
- A new loan will be taken out
- Rental increases will equal cost increases

The actual downpayment is calculated using data input in answer to questions. Monthly payments are given correctly as long as insurance and tax information is obtained. You'll get a true picture of the actual cash situation by comparing the tax break with the monthly cash flow.

The program allows a look at future years for return on investment, giving you an overview of the investment based on a constant inflation rate. Several runs will show you the effect of various inflation rates.

The Sample Run is for an actual listing in Southern California. Here, you can easily see the value of the printout listing all the factors considered. A special note to non-rental owners: The maintenance, etc., generally includes a figure equal to 5% of the total rent to cover water heaters and so forth. Also enter management costs here. Unfortunately there is no provision for a second trust deed or a loan assumption.

Of the assumptions, the only one that will cause inaccuracy is that all loan costs are deductable the first year. However, the non-deductable costs are generally small, and they are fully recoverable when you sell or refinance. The program as written will handle properties up to $1 million with inflation up to to $10 million.

North Star BASIC allows easy formatting of variables. Using %$C#13F2 causes all future variables to be printed as dollars and cents with commas. The 13 allows 13 total characters (including dollar sign, commas and decimal point). F2 gives two characters to the right of the decimal. The !%# removes the formatting from all future print statements.

If you wish, the program allows easy break out of any of the pieces of information, such as equity payoff the first year. In fact, you can easily modify the program to print out a complete amortization schedule, since the formulas are integral to it.

To get accurate information, you should check with insurance agents, banks, savings and loans, and title companies for their total actual charges, which may vary considerably. Also, you're not forced to go through the escrow company set up by the

Illustration by Stephen C. Fischer

broker. By shopping around, you can save several hundred dollars. Many title companies will do the whole escrow, saving money. By checking your local multiple listing service, you can get a fairly accurate real estate inflation factor and comparable prices to check out the value of the property you are interested in.

The 4-plex in the example actually sold for $138,000 due to some sharp bargaining by the buyer. It is obviously important not to pay more than necessary. However, inflation being what it is, too much just means a little longer to get the profit.

Purchase price is the final, agreed-upon figure. The down payment is the figure demanded by the lender (usually in the 10 to 30% range) and not the final amount paid into escrow. That figure is calculated for you by the program. The loan term from the lender will be 25 to 30 years. Closing costs are in points (percentage of money lent). You can find needed down payment, duration of loan, closing costs and interest rate by shopping lending institutions. Real estate taxes are furnished on the listing, as are the various expenses. Generally, expenses fall in the range of 5 to 15% of rents. There should also be a reduction in the rent receipts of about 5% as a vacancy factor.

The down payment printout shows a calculation of the cash down plus the points, closing costs and estimated tax and insurance impounds. The monthly mortgage payment is the principle, interest and impounds (tax and insurance) that is sent to the lender each month.

Land value input is used to figure depreciation for tax purposes. Only the structure goes down in value, so the land value must be subtracted from the purchase price. The tax bracket is the IRS figure at the adjusted gross income on your tax sheet. With our progressive income tax, a slight reduction in taxable income can mean real savings. Accelerated depreciation is used in this program because it saves more on taxes immediately. However, it can create tax problems if you sell in less than 10 years. The answer is not to sell, but to refinance or trade to pick up more property. The program figures all of the tax information, then figures out your return on investment based on increased equity, cash flow and tax savings divided by money paid into escrow.

Then you can pick additional time periods. For each of these periods, the program will show loan payback, new property value, equity growth, tax savings and return on investment. □

Sample Run

```
*****************************************
*                                       *
**********REAL ESTATE EVALUATOR**********
*                    L & S ENTERPRISES  *
*****************************************

FOR : LEO LION

ADDRESS HIDDEN
        HUNTINGTON BEACH

PURCHASE PRICE $142000
DOWN PAYMENT (%) 25
LOAN TERM (YEARS) 30
CLOSING COSTS-POINTS(% OF COST) 2
MORTGAGE INTEREST (%) 9.875
ADDITIONAL ESCROW COSTS $1700
REAL ESTATE TAXES PER YEAR $1420
HEATING COSTS PER MONTH $0
ELECTRICITY COSTS PER MONTH $0
WATER, MAINT., ETC. PER MONTH $67.83
INSURANCE PER MONTH $60
INCOME PER MONTH $963

DOWN PAYMENT (INCL. ESCROW) = $40,040.00

              CASH FLOW ANALYSIS

MONTHLY MORTGAGE PAYMENTS= $1,103.12
MONTHLY EXPENSES         =     $67.83

MONTHLY INCOME           =    $963.00

*****************************************
MONTHLY CASH FLOW        =   $-207.95
          WARNING NEGATIVE CASH FLOW
*****************************************

APPROX. VALUE OF LAND $26554
APPROX. TAX BRACKET (% OF INCOME) 40
NEW(1) OR USED(2) BUILDING 2

              INVESTMENT TAX ADVANTAGE

DEDUCTABLE INTEREST=$13,329.86 1ST YR.
REAL ESTATE TAXES=  $1,420.00 1ST YR
DEPRECIATION     = $7,215.38 1ST YR
EXPENSES         = $3,233.96 1ST YR

TOTAL DEDUCTABLE =$25,199.20 1ST YR
TOTAL INCOME     =$11,556.00 1ST YR

NET DEDUCTION    =$13,643.20 1ST YR

*****************************************
TAX BREAK        = $5,457.28 1ST YR
*****************************************
ANNUAL PROPERTY INFLATION(%) 10

RETURN ON INVESTMENT= 44.379261%  1ST YR

GROWTH           =  $17,769.46 1ST YR
SELECT OTHER PERIOD FOR RETURN ON INVESTMENT
HOW MANY YEARS?

HOW MANY YEARS?1
TOTAL PRINCIPLE PAID     =    $607.61
```

Sample Run continued

```
PROPERTY VALUE AFTER DESIRED TIME=$156,200.00
EQUITY GROWTH                    = $14,807.61
TAX SAVINGS OVER DESIRED TIME  $5,457.28

RETURN ON INVESTMENT OVER PERIOD= 44.379263 %

DO YOU WANT ANOTHER PERIOD Y(1) OR N(2)1
SELECT OTHER PERIOD FOR RETURN ON INVESTMENT
HOW MANY YEARS?2
TOTAL PRINCIPLE PAID     =    $1,278.02

PROPERTY VALUE AFTER DESIRED TIME=  $171,820.00
EQUITY GROWTH                    =   $31,098.02
TAX SAVINGS OVER DESIRED TIME    $9,073.44

RETURN ON INVESTMENT OVER PERIOD= 87.863619 %

DO YOU WANT ANOTHER PERIOD Y(1) OR N(2)1
SELECT OTHER PERIOD FOR RETURN ON INVESTMENT
HOW MANY YEARS?3
TOTAL PRINCIPLE PAID     =    $2,017.71

PROPERTY VALUE AFTER DESIRED TIME=  $189,002.00
EQUITY GROWTH                    =   $49,019.71
TAX SAVINGS OVER DESIRED TIME   $12,661.89

RETURN ON INVESTMENT OVER PERIOD= 135.35288 %

DO YOU WANT ANOTHER PERIOD Y(1) OR N(2)1
SELECT OTHER PERIOD FOR RETURN ON INVESTMENT
HOW MANY YEARS?4
TOTAL PRINCIPLE PAID     =    $2,833.84

PROPERTY VALUE AFTER DESIRED TIME=  $207,902.20
EQUITY GROWTH                    =   $68,736.04
TAX SAVINGS OVER DESIRED TIME   $16,219.76

RETURN ON INVESTMENT OVER PERIOD= 187.24791 %

DO YOU WANT ANOTHER PERIOD Y(1) OR N(2)1
SELECT OTHER PERIOD FOR RETURN ON INVESTMENT
HOW MANY YEARS?5
TOTAL PRINCIPLE PAID     =    $3,734.32

PROPERTY VALUE AFTER DESIRED TIME=  $228,692.42
EQUITY GROWTH                    =   $90,426.74
TAX SAVINGS OVER DESIRED TIME   $19,743.89
```

```
410 M2=(H+E+M)
420!"MONTHLY EXPENSES          = ",M2
430!
440!"MONTHLY INCOME            = ",R
450!
460 X=(P2+M2)
470!"****************************************"
480 C2=(R-X)
490!"MONTHLY CASH FLOW         = ",C2
500 IF C2<0 THEN 520
510 GOTO530
520!TAB(10),"WARNING NEGATIVE CASH FLOW"
530!"****************************************"
540!
550INPUT"APPROX. VALUE OF LAND $",V
560INPUT"APPROX. TAX BRACKET (% OF INCOME) ",B
570INPUT"NEW(1) OR USED(2) BUILDING ",U
580 B7=B/100
590 IF U=1 THEN 620
600 U1=1.25
610 GOTO 630
620 U1=2
630 D1=U1*((P4-V)/20)
640 G4=(12*M2)+C1+(I3*12)
650!
660!TAB(15),"INVESTMENT TAX ADVANTAGE"
670!
680 Y4=12
690 GOSUB 1240
700 C3=(C/100)*P4
710!"DEDUCTABLE INTEREST=",J1+C3," 1ST YR."
720!"REAL ESTATE TAXES= ",T," 1ST YR"
730!"DEPRECIATION    =",D1," 1ST YR"
740!"EXPENSES         =",G4," 1ST YR"
750!
760 J4=(J1+D1+T+G4+C3)
770!"TOTAL DEDUCTABLE =",J4," 1ST YR"
780!"TOTAL INCOME     =",R*12," 1ST YR"
790!
800!"NET DEDUCTION    =",J4-(R*12)," 1ST YR"
810 T5=(J4-(R*12))*B7
820!
830!"****************************************"
840 IF T5<0 THEN 870
850!"TAX BREAK        =",T5," 1ST YR"
860 GOTO890
870!TAB(15),"NO TAX BREAK"
880 T5=0
890 I5=D1+C3+C1-C2*12
```

```
RETURN ON INVESTMENT OVER PERIOD= 243.98966 %

DO YOU WANT ANOTHER PERIOD Y(1) OR N(2)2
READY
```

Program Listing

```
10!"*****************************************"
20!"*                                       *"
30!"***********REAL ESTATE EVALUATOR**********"
40!"*                        L & S ENTERPRISES  *"
50!"*****************************************"
60!
70 DIM A$(30)
80 INPUT"FOR : ",A$
90!
100 DIMB$(40)
110 INPUT"ADDRESS ",B$
120 DIM C$(30)
130 INPUT"        ",C$
140!
150INPUT"PURCHASE PRICE $",P4
160INPUT"DOWN PAYMENT (%) ",D
170INPUT"LOAN TERM (YEARS) ",L
180INPUT"CLOSING COSTS-POINTS(% OF COST) ",C
190INPUT"MORTGAGE INTEREST (%) ",I
200INPUT"ADDITIONAL ESCROW COSTS $",C1
210INPUT"REAL ESTATE TAXES PER YEAR $",T
220INPUT"HEATING COSTS PER MONTH $",H
230INPUT"ELECTRICITY COSTS PER MONTH $",E
240INPUT"WATER, MAINT., ETC. PER MONTH $",M
250INPUT"INSURANCE PER MONTH $",I3
260INPUT"INCOME PER MONTH $",R
270 F=(100.00-D)*P4/100
280 I1=I/1200.00
290 M1=L*12
300 V1=(1.00000+I1)^M1
310!%$C#10F2
320 D6=(D*P4/100)+C1+(C*P4/100)
330!"DOWN PAYMENT (INCL. ESCROW) = ",D6
340!
350 P=(I1*V1)/(V1-1.00000)*F
360 P2=P+I3+(T/12)
380!TAB(15),"CASH FLOW ANALYSIS"
390!
400!"MONTHLY MORTGAGE PAYMENTS=",P2
900!"*****************************************"
910INPUT"ANNUAL PROPERTY INFLATION(%) ",I6
920 D6=(D*P4/100)+C1+(C*P4/100)
930 M5=1
940 V4=((1+I6/100)^M5)*P4
950 E6=(V4-P4+J2)
960!%#
970!"RETURN ON INVESTMENT=",((E6+12*(C2)+T5)/
   (D6))*100,"%  1ST YR"
980!%$C#11F2
990!"GROWTH              = ",E6+(C2)*12+T5," 1ST YR"
1000!"SELECT OTHER PERIOD FOR RETURN ON INVESTMENT"
1010INPUT"HOW MANY YEARS?",M5
1020 Y4=M5*12
1030 F=F+J2
1040 GOSUB 1240
1050 V4=((1+I6/100)^M5)*P4
1060!"TOTAL PRINCIPLE PAID     =",J2
1070!
1080!"PROPERTY VALUE AFTER DESIRED TIME=",V4
1090!"EQUITY GROWTH                    =",V4-(P4-J2)
1100 W=(C3+J1+C1)+(D1+T+(I3+M2-R)*12)*M5
1110 E6=(V4-P4+J2)
1120 D6=((D+C)*P4/100)+C1
1130 B7=B/100
1140!"TAX SAVINGS OVER DESIRED TIME",W*B7
1150 R7=(P4*(1+I6/100)^M5)-P4+(W*B7)/(P4*D/100)-C2+C1
1160 C8=(R-X)*Y4
1170 T5=W*B7
1180!%#
1190!"RETURN ON INVESTMENT OVER PERIOD="
    ((E6+C8+T5)/(D6))*100," %"
1200!%$C#13F2
1210INPUT"DO YOU WANT ANOTHER PERIOD Y(1) OR N(2)",O
1220 IF O=1 THEN 1000
1230 END
1240 J1=0
1250 J2=0
1260 J3=0
1270 FOR J=1 TO Y4
1280 I2=I1*F
1290 P1=P-I2
1300 F=F-P1
1310 J1=J1+I2
1320 J2=J2+P1
1330 J3=J3+P
1340 NEXT J
1350 RETURN
```

Tracking Costs in a Service Business

BY CLINT HENTZ

When operating a small business which sells a service, you should know if the cost to render the service is in line with the price quoted to the customer. The followng program, written for TRS-80 Level II, can guide you when experimenting with these figures.

One version of the listed program is working very well in an upholstering shop doing about $400,000 per year and is also working in a major appliance and TV repair shop, where it keeps track of service contract costs by manufacture and years of customer contract ownership. With imagination you can alter the program to fit other applications such as an automobile repair shop, custom drapery shop, carpet installation service or similar types of businesses.

There are two things to do before you experiment with the program. First, obtain or determine the hourly cost to operate the business. While the hourly method is not the most professional procedure to adopt, it will be interesting to see how close the figures come out by using the hourly rate. The rate-must be factual and your employees' time on the job properly recorded.

Next, divide the work you're tracking into primary items and variations of the primary item. Chairs, sofas, hidabeds and loveseats are examples of primary items in a reupholstering shop. Tufting, nail head trim, skirts and cushions are variations of primary items.

For demonstration purposes, the listed program and related data cover only three employees, six days, three primary items and a total of seven variation items. Of course, each of the items can be changed to fit your needs by following the suggestions provided later in the article.

Data for the program can be taken directly from work tickets. You should have all the required information in a specific location and sequence on the work ticket to reduce errors when entering the information into the computer. The only information not on current work tickets would be your classification of the primary and variation numbers.

A program menu gives a preview of the available reports. Report number one prints out a very detailed report of the data and requires the most time to run. Report number two gives the retail dollars completed on each specific day. The program allows the days covered in the report to be described as a working day or a non working day, such as a Sunday or a specific holiday. Report number three gives you information relative to direct labor workers. Number four is not a report but assists in locating a problem when an error occurs due to the wrong number of READs for DATA entries. I've noticed that it's easy to omit a data item or to forget a comma between entries. I suggest you run number four before any of the other reports. Number five prints out all of the labor items, along with the revised cost, which exceeded the figures on the list from which the work was priced. Report five could be changed to print out labor items which were a given percentage under the price list, thereby allowing those items to be used for a special sale.

I realize the listed program may not be the most efficient one possible. No doubt others could write a more sophisticated version. But I consider it more important to have a program work and produce desired information than to worry about program sophistication.

Suggestions

The following information, relative to the demonstration program, points out lines you'll need to change to meet your needs:

Line 20 — Number 91-97 indicates days covered. 91 was Sunday April 1. 97 was Saturday April 7. These numbers can be taken from a small desk type calendar or can be determined from a regular calendar by using January 1 as number 1 through December 31 as number 365.

Line 160 — Number of primary items. Change the number 3 to meet your needs.

Line 170 — C=1 indicates primary item number one.
J=2, with two variations.

Line 180 — C=2, primary item number
J1=3, with three variations.
These must correspond to numbers in line 480 to 540.

Lines 240 - 50 60 Description of primary items.

Line 340 — H=20.00. The 20.00 is the hourly rate used in the program. You must establish your own rate.

Line 350 — # is the format symbol for numbers, % for strings, for TRS- 80. Check your computer for correct format.

Line 480 — U=390 is the retail labor price for primary item number one, variation number one. L=13 is the amount of material. 13 is the yards of material to be sold for primary item one, variation number one.

Line 740 — Days covered. Must be days covered in data entries.

Line 770 — B5=91 if Sunday April 1. Change to proper day. If report was for December, the 25th could have Christmas printed on the report. The 25th is day number 359. The line would read IF B5=359 PRINT "CHRISTMAS".

Line 950 — 3 indicates three employees. No problem to change this figure.

Line 1190 — 7 adds up to total of J1 numbers in lines 170, 180 and 190.

Line 1340 — 1=Primary number
1=Variation number
10.5=Direct labor hours
16.75=Total labor hours
12.5=Yards of material used
8.75=Price per unit (yard) at cost
590=Retail selling price on salespersons sheet
96=Day work was completed
1=Worker identification number
R= Salesperson's initial
Johnston=Customer's last name

Line 1470 — Sentinel to avoid out of data error.

When running report number one, set the tape cassette to record. When running report number five, rewind tape and set cassette to play position. □

Program Listing

```
10 PRINT"TYPE IN DATE OF THIS REPORT & DAYS COVERED"
20 PRINT" EXAMPLE    JUNE 15 1979   91 -97"
30 INPUT D$
40 LPRINT"DATE  & DAYS COVERED BY THIS REPORT      ";D$
50 LPRINT" ":LPRINT"  "
60 PRINT"              1. PRODUCTION INFORMATION"
70 PRINT"              2. PRODUCTION $ PER DAY"
80 PRINT"              3. WORKERS PRODUCTION "
90 PRINT"              4. DATA ENTRY CHECK"
100 PRINT"             5. VERIFICATION OF LABOR/YARDAGE"
110 PRINT:PRINT
120 INPUT"                TYPE IN SELECTION #";O9
130 ON O9 GOTO 140 ,730 ,930 ,1270 ,1150
140 REM C= NUMBER OF PRIMARY ITEMS
150 REM J1=NUMBER VARIATIONS
160 FOR C= 1 TO 3
170 IF C = 1 THEN J1 =2
180 IF C = 2 THEN J1 = 3
190 IF C = 3 THEN J1 = 2
200 FOR J= 1 TO J1
210 LPRINT"  ": LPRINT"  "
220 LPRINT"- - - -
```

Program Listing continued

```
470 REM  U= CURRENT PRICE LIST LABOR & L=CURRENT YARDAGE  OR MATERIAL LIST"
480 IF (C=1)AND(J=1)THEN U=390:L=13
490 IF (C=1)AND(J=2)THEN U=395:L=16
500 IF (C=2)AND(J=1)THEN U=230:L=6
510 IF (C=2)AND(J=2)THEN U=275:L=8
520 IF (C=2)AND(J=3)THEN U=300:L=10
530 IF (C=3)AND(J=1)THEN U=330:L=12
540 IF (C=3)AND(J=2)THEN U=340:L=14
550 Y$="DIFFERENCE OF ####.## OVER TOTAL COST"
560 LPRINT USINGY$;(G1/X)-((H*V)+Q)/X
570 K$="RETAIL LABOR  ####.##   DIFFERENCE OF ####.## "
580 IF((H*V)/X)>U LPRINT" *** WARNING CHECK LABOR PRICE NEXT LINE ***"
590 LPRINT USING K$;U,U-(H*V)/X
600 P=0:A5=H*V/X
610 REM PRINT#-1 INDICATES DATA TO CASSETTE NUMBER ONE
620 IF A5>U PRINT#-1,C,J,X,A5 ELSE PRINT#-1,C,J,X,P
630 O$="AVERAGE YDS CONSUMED    ##.#    SOLD  ##.#  DIFFERENCE OF ##.#"
640 LPRINT USING O$;W/X,L,(W/X)-L
650 A4=W/X
660 IF A4 > L PRINT#-1,A4 ELSE PRINT#-1,P
670 L1$="AVERAGE UPH HOURS  ###.##"
680 L2$="AVERAGE TOTAL HRS  ###.##"
690 LPRINT USING L1$;T2/X:LPRINT USING L2$;V/X
700 RESTORE:NEXT J: NEXT C
710 PRINT:PRINT
720 END
730 LPRINT"  REPORT # 2 .. DOLLARS PRODUCED PER DAY"
740 FOR B5=91 TO 97
750 V5=0:LPRINT"--------------------------------"
760 LPRINT" DAY ";B5
770 IF B5=91 LPRINT"SUNDAY"
780 IF B5=92 LPRINT "SHOP CLOSED"
790 IF B5=97 LPRINT"SATURDAY"
800 X5=0:N5=0:H5=0:Z5=0
810 READ Q5,W5,R5,K7,T5,Y5,U5,I5,H4,Z$,Z9$
820 IF I5=-1 GOTO 890
830 IF I5=B5 GOTO 850
840 GOTO 810
850 Z5=Z5+1:N5=N5+U5:X5=X5+1:V5=V5+R5
860 K5$="  ###   ####.##   ####.##  % %  %              %"
870 LPRINT USING K5$;Z5,U5,R5,Z$,Z9$
880 H5=H5+U5:GOTO 810
890 LPRINT"--------------------------------"
900 K6$="  ###  $######.##  ####.## HOURS"
910 LPRINT USING K6$;X5,H5,V5
920 RESTORE:NEXT:END
930 LPRINT" REPORT # 3  EMPLOYEE PRODUCTION "
940 REM J6= NUMBER OF EMPLOYEES
```

Sample Run

```
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

SOFA   ( CLASS 1 )
GROUP  CLASS  UPH     TOTAL  YARDS  PRICE  Y*P     SOLD    CUSTOMER     DAY  UPH #
 1 R    1     10.5    10.5   13.5   8.8   118.13   590.00  JOHNSTON     96    1
 1 E    1     11.3    21.8   13.8   9.1   125.13   535.00  TOWNSEND     94    2
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
  2            21.8    35.3   27.25        243.25  1125.00

AVG LABR/COST  352.50 + YDS $ OF 121.63 =  474.13 RETAIL OF  562.50
DIFFERENCE OF   88.38 OVER TOTAL COST
RETAIL LABOR   390.00   DIFFERENCE OF   37.50
AVERAGE YDS CONSUMED    13.6    SOLD  13.0  DIFFERENCE OF  0.6
AVERAGE UPH HOURS   10.88
AVERAGE TOTAL HRS   17.63
```

```
LOVESEAT   ( CLASS 2 )
GROUP  CLASS  UPH     TOTAL  YARDS  PRICE  Y*P     SOLD    CUSTOMER     DAY  UPH #
 3 R    2     14.0    14.0   17.0   7.3   123.25   745.00  SMITH        94    3
 3 R    2     15.0    29.0   15.5   8.0   123.23   520.00  KEHL         96    1
 3 E    2     14.5    43.5   14.8   8.2   120.95   590.00  KIMES        95    2
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
  3            43.5    53.8   47.25        367.43  1855.00

AVG LABR/COST  358.33 + YDS $ OF 122.48 =  480.81 RETAIL OF  618.33
DIFFERENCE OF  137.52 OVER TOTAL COST
 *** WARNING CHECK LABOR PRICE NEXT LINE ***
RETAIL LABOR   340.00   DIFFERENCE OF  -18.33
AVERAGE YDS CONSUMED    15.8    SOLD  14.0  DIFFERENCE OF  1.8
AVERAGE UPH HOURS   14.50
AVERAGE TOTAL HRS   17.92
```

```
  REPORT # 2 .. DOLLARS PRODUCED PER DAY
--------------------------------
 DAY  91
SUNDAY
--------------------------------
    0  $    0.00     0.00 HOURS
--------------------------------
 DAY  92
SHOP CLOSED
```

```
950 FOR J6= 1 TO 3
960 X4=0:S4=0:T4=0
970 LPRINT"  "
980 LPRINT"  DATA FOR  ";
990 IF J6=1 LPRINT"BARRY    ID # 1"
1000 IF J6=2 LPRINT"JAMES    ID # 2"
1010 IF J6=3 LPRINT"ROBERT   ID # 3"
1020 LPRINT"  ITEMS   $ PRODUCED   HRS  AVG $ HR.  CUSTOMER"
1030  READ A4,B4,C4,H7,D4,E4,F4,G4,H4,Z$,Z9$
1040 IF H4=-1 GOTO 1120
1050 IF H4=J6 GOTO 1070
1060 GOTO 1030
1070 X4=X4+1:S4=S4+F4
1080 K8$=" #### % % #####.##  #####.##  ####.##  %           %"
1090 T4=T4+C4
1100 LPRINT USING K8$;X4,Z$,F4,C4,F4/C4,Z9$
1110 GOTO 1030
1120 IF T4=0 GOTO 1140
1130 LPRINT"  ":LPRINT USING K8$;X4,"    ",S4,T4,S4/T4
1140 RESTORE:NEXTJ6:END
1150 LPRINT" REPORT # 5 VERIFICATION OF LABOR/MATERIAL"
1160 LPRINT"   "
1170 LPRINT" ITEM  VARIATION  ACTIVITY  NEW COST   NEW MATERIAL"
1180 B$= "  ##       ##        ####     ####.##       ###.#"
1190 FOR I=  1 TO 7
1200 REM INPUT#-1 INDICATES DATA IN FROM CASSETTE NUMBER ONE
1210 INPUT#-1,  A,B,C,D
1220 INPUT#-1,E
1230 LPRINT USING B$;A,B,C,D,E
1240 IF (A=3) AND(B=2) THEN 1260
1250 NEXT I
1260 END
1270 LPRINT"DATA ..  READ    CHECK"
1280 READ A,B,C,D,E,F,G,H,I,A$,B$
1290 IF A=-1 GOTO 1330
1300 M$=" #  ##  ###.## ###.##  ###.##  ###.## ####.##  ## # % %  %           %"
1310 LPRINT USING M$;A,B,C,D,E,F,G,H,I,S$,B$
1320 GOTO 1280
1330 END
1340 DATA 1,1,10.5,16.75,12.5,8.75,590,96,1,R,JOHNSTON
1350 DATA 2,1,15,26,17,9.50,700,93,2,E,FISHER
1360 DATA 3,2,14,18,16,7.25,745,94,3,R,SMITH
1370 DATA 2,1,8,15.25,8,4.40,329,95,1,D,MORELAND
1380 DATA 1,2,15.5,21.75,12.5,10.50,750,95,2,E,ROBERTS
1390 DATA 1,2,15.75,26.25,11,4.75,595,95,1,D,HINTON
1400 DATA 2,2,7.5,12.5,5,8.70,356,93,3,R,SWEENEY
1410 DATA 1,2,14.25,20.25,13.0,9.90,730,94,1,E,KING
1420 DATA 1,1,11.25,18.5,12.75,9.10,535,94,2,E,TOWNSEND
1430 DATA 1,2,13.75,20,12.5,8.50,690,96,3,E,WILKERSON
1440 DATA 3,2,15,17.25,14.5,7.95,520,96,1,R,KEHL
1450 DATA 1,2,12.5,18.5,13.5,10.50,795,93,3,E,MASON
1460 DATA 3,2,  14.5,18.5,13.75,8.20,590,95,2,E,KIMES
1470 DATA -1,-1,-1,-1,-1,-1,-1,-1,-1,XXX,XXX
```

```
--------------------------------
   0  $    0.00     0.00 HOURS
--------------------------------


DAY  96
   1    590.00     10.50  R    JOHNSTON
   2    690.00     13.75  E    WILKERSON
   3    520.00     15.00  R    KEHL
--------------------------------
   3  $ 1800.00    39.25 HOURS
--------------------------------
 DAY  97
SATURDAY
--------------------------------
   0  $    0.00     0.00 HOURS


REPORT # 3  EMPLOYEE PRODUCTION

 DATA FOR  BARRY    ID # 1
 ITEMS   $ PRODUCED   HRS  AVG $ HR.   CUSTOMER
   1 R     590.00     10.50    56.19  JOHNSTON
   2 D     329.00      8.00    41.13  MORELAND
   3 D     595.00     15.75    37.78  HINTON
   4 E     730.00     14.25    51.23  KING
   5 R     520.00     15.00    34.67  KEHL


   3 E     690.00     13.75    50.18  WILKERSON
   4 E     795.00     12.50    63.60  MASON

   4      2586.00     47.75    54.16


DATA ..  READ    CHECK
 1   1   10.50  16.75   12.50    8.75  590.00  96 1      JOHNSTON
 2   1   15.00  26.00   17.00    9.50  700.00  93 2      FISHER


DATE  & DAYS COVERED BY THIS REPORT      JUNE 15 1979     91 - 97


 REPORT # 5 VERIFICATION OF LABOR/MATERIAL

 ITEM  VARIATION  ACTIVITY  NEW COST   NEW MATERIAL
   1        1         2       0.00        13.6
   1        2         5     427.00         0.0
   2        1         2     412.50        13.5
   2        2         1       0.00         0.0
   3        2         3     358.33        15.8
```

Coin Collecting

BY CHARLES D. STERNBERG

Coin collecting and personal computers mix very well as shown by the following programs for the computerized numismatist. Various potential categorizations of coins, as well as the variety of data maintained about the individual items, makes the computer an able assistant in monitoring and maintaining the hobbyist's collection.

While the basic items of information about coins remains constant between collectors, differences do occur in data use. To satisfy the various needs of coin collectors two major factors were considered in the design and development of the programs. First, the programs had to retrieve selected items/coin identifiers from the collector's files; and second, the programs had to be written in an easy-to-read/easy-to-modify form, for simplicity in personalizing the programs for the individual's use.

Two versions of the program are provided for both serious and not-so-serious collectors. Version one is for collectors who delight in the completeness of their collection and enjoy reviewing their collection's various coin types, mints and denominations. Version two is for more profit-minded collectors/investors who are more interested in monitoring the value and profit potential of the collection than its content. In either case the programs' modularity and simplicity allow ease of modification of both logic and input or output format.

Version one offers the user a personal "curator" for the collection. The program accepts individual items as DATA statements and then prints all, or selected, items based upon keyboard responses. Data items included for the collection's contents are coin date, denomination, mint, coin type, number minted and condition of the coin.

Version two maintains information concerning the investment value and potential of individual items in the collection. The program accepts the items from DATA statements and prints all, or selected, categories of items. If desired, a total cost and value summarization is computed and printed for the coins. Data items provided for each are coin data, denomination, mint, coin type, number minted, purchase data, quantity, purchase cost and current value. □

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Program Listing – Version One

```
20 REM    COIN COLLECTION PROGRAM
30 REM   **********   DATA INITIALIZATION   **********
40 M=1000
50 REM  **********PROCESSING STARTS   **********
60 PRINT "SHALL I PRINT ALL OF THE ENTRIES ( Y OR N )?"
70 INPUT A$
80 IF A$<>"Y" THEN 230
90 REM   ********** PRINT ROUTINE FOR  "ALL" ENTRIES  *********
100 PRINT
110 PRINT
120 PRINT
130 PRINT "DATE";TAB(8);"SIZE";TAB(14);"MINT";TAB(22);"TYPE";TAB(36);
140 PRINT "NBR (MIL)";TAB(47);"CONDITION"
150 PRINT "----";TAB(8);"----";TAB(14);"----";TAB(20);"----------";
160 PRINT TAB(36);"---------";TAB(47);"---------"
170 FOR I = 1 TO M
180   READ D$
190   IF D$="END" THEN  990
200   READ S$,M$,T$,N,C$
210   PRINT D$;TAB(8);S$;TAB(15);M$;TAB(20);T$;TAB(36);N;TAB(47);C$
220 NEXT I
230 PRINT "WHAT SHALL I SEARCH FOR: DATE(D),  DENOMINATION SIZE (S)"
240 PRINT "                         MINT (M), OR TYPE (T)?"
250 INPUT A$
260 IF A$="T" THEN 820
270 IF A$="S" THEN 460
280 IF A$="M" THEN 640
290 REM   ********** DATE SEARCH AND PRINT   **********
300 PRINT "ENTER THE DATE TO SEARCH FOR"
310 INPUT X$
320 PRINT
330 PRINT
340 PRINT " ";X$;TAB(8);"SIZE";TAB(14);"MINT";TAB(22);"TYPE";
350 PRINT  TAB(36);"NBR (MIL)";TAB(47);"CONDITION"
360 PRINT TAB(8);"----";TAB(14);"----";TAB(20);"----------";
370 PRINT TAB(36);"---------";TAB(47);"---------"
380 FOR I = 1 TO M
390   READ D$
400   IF D$="END" THEN 990
410   READ S$,M$,T$,N,C$
420   IF D$<> X$ THEN 440
430   PRINT  TAB(8);S$;TAB(15);M$;TAB(20);T$;TAB(36);N;TAB(47);C$
440 NEXT I
450 GOTO 990
460  REM   ********   DENOMINATION SIZE SEARCH AND PRINT   ********
470 PRINT "ENTER THE DENOMINATION SIZE TO SEARCH FOR"
480 INPUT X$
490 PRINT
500 PRINT
510 PRINT
520 PRINT " ";X$;TAB(8);"DATE";TAB(14);"MINT";TAB(22);"TYPE";
530 PRINT TAB(36);"NBR (MIL)";TAB(47);"CONDITION"
540 PRINT TAB(8);"----";TAB(14);"----";TAB(20);"----------";
550 PRINT TAB(36);"---------";TAB(47);"---------"
560 FOR I = 1 TO M
570   READ D$
580   IF D$="END" THEN 990
590   READ S$,M$,T$,N,C$
600   IF  S$<> X$ THEN 620
610   PRINT TAB(8);D$;TAB(15);M$;TAB(20);T$;TAB(36);N;TAB(45);C$
620 NEXT I
630 GOTO 990
640 REM    **********   MINT SEARCH AND PRINT   **********
650 PRINT "ENTER THE MINT TO SEARCH FOR"
660 INPUT X$
670 PRINT
680 PRINT
```

```
690 PRINT
700 PRINT " ";X$;TAB(8);"DATE";TAB(15);"SIZE";TAB(22);"TYPE";
710 PRINT TAB(36);"NBR (MIL)";TAB(47);"CONDITION"
720 PRINT TAB(8);"----";TAB(15);"----";TAB(20);"----------";
730 PRINT TAB(36);"---------";TAB(47);"---------"
740 FOR I = 1 TO M
750   READ D$
760   IF D$ = "END" THEN 990
770   READ S$,M$,T$,N,C$
780   IF M$<> X$ THEN 800
790   PRINT TAB(8);D$;TAB(15);S$;TAB(20);T$;TAB(36);N;TAB(47);C$
800 NEXT I
810 GOTO 990
820 REM   ***************TYPE SEARCH AND PRINT    ****************
830 PRINT "ENTER THE TYPE TO SEARCH FOR"
840 INPUT X$
850 PRINT
860 PRINT
870 PRINT
880 PRINT " ";X$;TAB(16);"DATE";TAB(24);"SIZE";TAB(31);"MINT";
890 PRINT TAB(36);"NBR (MIL)";TAB(47);"CONDITION"
900 PRINT TAB(16);"----";TAB(24);"----"TAB(31);"----";TAB(36);
910 PRINT "---------";TAB(47);"---------"
920 FOR I = 1 TO M
930   READ D$
940   IF D$="END" THEN 990
950   READ S$,M$,T$,N,C$
960   IF T$<> X$ THEN 980
970   PRINT TAB(16);D$;TAB(24);S$;TAB(32);M$;TAB(36);N;TAB(45);C$
980 NEXT I
990 REM   **********  PROGRAM TERMINATION POINT    *************
1000 PRINT
1010 PRINT
1020 STOP
1030 REM   **************   DATA ENTRIES FOLLOW    ****************
```

Symbol Table – Version One

```
  MAJOR SYMBOL TABLE - COINS
I-----------------------------------------I
I NAME    .. DESCRIPTION                  I
I-----------------------------------------I
I  M      .. MAXIMUM NUMBER OF DATA READS I
I  D$     .. DATE OF COIN                 I
I  S$     .. SIZE (DENOMINATION) OF COIN  I
I  M$     .. MINT OF COIN                 I
I  T$     .. COIN TYPE                    I
I  N      .. NBR MINTED (MILLIONS)        I
I  C$     .. COIN CONDITION               I
I  X$     .. ITEM TO SEARCH FOR           I
I-----------------------------------------I

     FUNCTIONS USED
I-----------------------------------------I
I NAME    .. DESCRIPTION                  I
I-----------------------------------------I
I  TAB    .. FORMATS PRINT  LINES         I
I-----------------------------------------I
```

Sample Data – Version One

```
1040 DATA 1947,.25,D,FRANKLIN,10.00,VF
1050 DATA 1944,.05,S,SILVER,22.00,PROOF
1060 DATA 1965,.10,D,FLAW,114.1,F
1070 DATA 1978,M,S,PROOF SET,3.2,PROOF
1080 DATA 1979,M,P,MINT SET,4.50,UNC
1090 DATA 1945,.05,D,SILVER,16.47,VF
1100 DATA 1907,.01,S,,.35,G
1110 DATA 1901,.01,,INDIAN,.86,G
1120 DATA 1865,1.00,CC,,65.17,G
1130 DATA 1945,.25,S,FRANKLIN,8.89,F
1140 DATA END
```

Sample Output – Version One

```
SHALL I PRINT ALL OF THE ENTRIES ( Y OR N )?
? Y

DATE    SIZE  MINT    TYPE          NBR (MIL)  CONDITION
----    ----  ----  ----------      ---------  ---------
1947    .25     D   FRANKLIN          10       VF
1944    .05     S   SILVER            22       PROOF
1965    .10     D   FLAW              114.1    F
1978    M       S   PROOF SET         3.2      PROOF
1979    M       P   MINT SET          4.5      UNC
1945    .05     D   SILVER            16.47    VF
1907    .01     S                     .35      G
1901    .01         INDIAN            .86      G
1865    1.00    CC                    65.17    G
1945    .25     S   FRANKLIN          8.89     F

BREAK IN 1020

RUN
SHALL I PRINT ALL OF THE ENTRIES ( Y OR N )?
? N
WHAT SHALL I SEARCH FOR: DATE(D),  DENOMINATION SIZE (S)
                         MINT (M), OR TYPE (T)?
? S
ENTER THE DENOMINATION SIZE TO SEARCH FOR
? M

 M      DATE  MINT    TYPE          NBR (MIL)  CONDITION
        ----  ----  ----------      ---------  ---------
        1978    S   PROOF SET         3.2      PROOF
        1979    P   MINT SET          4.5      UNC
```

Program Listing – Version Two

```
20 REM   COIN INVESTMENT RECORD PROGRAM
30 REM   **************   DATA INITIALIZATION   **********************
40 M=1000
50 REM  **************PROCESSING STARTS   ***************************
60 PRINT "SHALL I PRINT ALL OF THE ENTRIES ( Y OR N )?"
70 INPUT A$
80 PRINT "SHALL I PRODUCE TOTAL COSTS/VALUES FOR YOU (Y OR N )?"
90 INPUT A1$
100 IF A$<>"Y" THEN 310
110 REM   ***************** PRINT ROUTINE FOR  "ALL" ENTRIES  *********
120 PRINT
130 PRINT
140 PRINT
150 PRINT "DATE";TAB(8);"SIZE";TAB(14);"COND";TAB(22);"TYPE";TAB(34);
160 PRINT "NBR (MIL)";TAB(47);"PRCH";TAB(53);"QTY";TAB(59);"COST";
170 PRINT TAB(64);"VALUE"
180 PRINT "----";TAB(8);"----";TAB(14);"----";TAB(20);"----------";
190 PRINT TAB(34);"---------";TAB(45);"-------";TAB(53);"---";
200 PRINT TAB(59);"----";TAB(64);"-----"
210 FOR I = 1 TO M
220   READ D$
230   IF D$="END" THEN  1310
240   READ S$,M$,T$,N,C$,P$,Q,C,V
250   PRINT D$;M$;TAB(8);S$;TAB(15);C$;TAB(20);T$;TAB(36);N;TAB(44);
260   PRINT P$;TAB(53);Q;TAB(58);C;TAB(64);V
270   IF A1$ <> "Y" THEN 300
280   C1=C1+(C*Q)
290   V1=V1+(V*Q)
300 NEXT I
310 PRINT "WHAT SHALL I SEARCH FOR: DATE(D),  DENOMINATION SIZE (S)"
```

```
320 PRINT "                              MINT (M), OR TYPE (T)?"
330 INPUT A$
340 IF A$="T" THEN 1080
350 IF A$="S" THEN 600
360 IF A$="M" THEN 840
370 REM   ************ DATE SEARCH AND PRINT   ******************
380 PRINT "ENTER THE DATE TO SEARCH FOR"
390 INPUT X$
400 PRINT
410 PRINT
420 PRINT " ";X$;TAB(8);"SIZE";TAB(14);"COND";TAB(22);"TYPE";TAB(34);
430 PRINT "NBR (MIL)";TAB(47);"PRCH";TAB(53);"QTY";TAB(59);"COST";
440 PRINT  TAB(64);"VALUE"
450 PRINT TAB(8);"----";TAB(14);"----";TAB(20);"----------";
460 PRINT TAB(34);"---------";TAB(45);"-------";TAB(53);"---";
470 PRINT TAB(59);"----";TAB(64);"-----"
480 FOR I = 1 TO M
490   READ D$
500   IF D$="END" THEN 1310
510   READ S$,M$,T$,N,C$,P$,Q,C,V
520   IF D$<> X$ THEN 580
530   PRINT TAB(5)M$;TAB(8);S$;TAB(15);C$;TAB(20);T$;TAB(36);N;TAB(44);
540   PRINT P$;TAB(53);Q;TAB(58);C;TAB(64);V
550   IF A1$ <> "Y" THEN 580
560   C1=C1+(C*Q)
570   V1=V1+(V*Q)
580 NEXT I
590 GOTO 1310
600  REM   ********   DENOMINATION SIZE SEARCH AND PRINT   ********
610 PRINT "ENTER THE DENOMINATION SIZE TO SEARCH FOR"
620 INPUT X$
630 PRINT
640 PRINT
650 PRINT
660 PRINT " ";X$;TAB(8);"DATE";TAB(14);"COND";TAB(22);"TYPE";TAB(34);
670 PRINT "NBR (MIL)";TAB(47);"PRCH";TAB(53);"QTY";TAB(59);"COST";
680 PRINT TAB(64);"VALUE"
690 PRINT TAB(8);"----";TAB(14);"----";TAB(20);"----------";
700 PRINT TAB(34);"---------";TAB(45);"-------";TAB(53);"---";
710 PRINT TAB(59);"----";TAB(64);"-----"
720 FOR I = 1 TO M
730   READ D$
740   IF D$="END" THEN 1310
750   READ S$,M$,T$,N,C$,P$,Q,C,V
760   IF  S$<> X$ THEN 820
770   PRINT TAB(8);D$;M$;TAB(15);C$;TAB(20);T$;TAB(36);N;TAB(44);
780   PRINT P$;TAB(53);Q;TAB(58);C;TAB(64);V
790   IF A1$ <> "Y" THEN 820
800   C1=C1+(C*Q)
810   V1=V1+(V*Q)
820 NEXT I
830 GOTO 1310
840 REM    **********   MINT SEARCH AND PRINT   ****************
850 PRINT "ENTER THE MINT TO SEARCH FOR"
860 INPUT X$
870 PRINT
880 PRINT
890 PRINT
900 PRINT " ";X$;TAB(5);"DATE CD";TAB(15);"SIZE";TAB(22);"TYPE";
910 PRINT TAB(34);"NBR (MIL)";TAB(47);"PRCH";TAB(53);"QTY";TAB(59);
920 PRINT "COST";TAB(64);"VALUE"
930 PRINT TAB(5);"---- --";TAB(15);"----";TAB(20);"----------";
940 PRINT TAB(34);"---------";TAB(45);"-------";;TAB(53);"---";
950 PRINT TAB(59);"----";TAB(64);"-----"
960 FOR I = 1 TO M
970   READ D$
980   IF D$ = "END" THEN 1310
990   READ S$,M$,T$,N,C$,P$,Q,C,V
1000   IF M$<> X$ THEN 1060
1010   PRINT TAB(5);D$;TAB(10);C$TAB(15);S$;TAB(20);T$;TAB(36);N;
1020   PRINT TAB(44);P$;TAB(53);Q;TAB(58);C;TAB(64);V
1030   IF A1$<>"Y" THEN 1060
```

```
1040    C1=C1+(C*Q)
1050    V1=V1+(V*Q)
1060 NEXT I
1070 GOTO 1310
1080 REM    **************TYPE SEARCH AND PRINT    ****************
1090 PRINT "ENTER THE TYPE TO SEARCH FOR"
1100 INPUT X$
1110 PRINT
1120 PRINT
1130 PRINT
1140 PRINT " ";X$;TAB(16);"DATE";TAB(24);"SIZE";TAB(29);"COND";
1150 PRINT TAB(34);"NBR (MIL)";TAB(47);"PRCH";TAB(53);"QTY";TAB(59);
1160 PRINT "COST";TAB(64);"VALUE"
1170 PRINT TAB(16);"----";TAB(24);"----";TAB(29);"----";TAB(34);
1180 PRINT "---------";TAB(45);"-------";TAB(53);"---";
1190 PRINT TAB(59);"----";TAB(64);"-----"
1200 FOR I = 1 TO M
1210    READ D$
1220    IF D$="END" THEN 1310
1230    READ S$,M$,T$,N,C$,P$,Q,C,V
1240    IF T$<> X$ THEN 1300
1250    PRINT TAB(16);D$;TAB(24);S$;TAB(30);C$;TAB(34);N;TAB(44);
1260    PRINT P$;TAB(53);Q;TAB(58);C;TAB(64);V
1270    IF A1$ <> "Y" THEN 1300
1280    C1=C1+(C*Q)
1290    V1=V1+(V*Q)
1300 NEXT I
1310 REM    **********  PROGRAM TERMINATION POINT    *************
1320 PRINT
1330 PRINT
1340 IF A1$ <> "Y" THEN 1430
1350 PRINT "**************************"
1360 PRINT "  TOTAL COST WAS ";C1
1370 PRINT "**************************"
1380 PRINT "  TOTAL VALUE IS  ";V1
1390 PRINT "**************************"
1400 PRINT
1410 PRINT
1420 PRINT
1430 STOP
1440 REM    **************    DATA ENTRIES FOLLOW    ****************
```

Symbol Table – Version Two

```
  MAJOR SYMBOL TABLE - COIN INVESTMENTS
I-----------------------------------------I
I NAME    .. DESCRIPTION                  I
I-----------------------------------------I
I  M      .. MAXIMUM NUMBER OF DATA READS I
I  D$     .. DATE OF COIN                 I
I  S$     .. SIZE (DENOMINATION) OF COIN  I
I  M$     .. MINT OF COIN                 I
I  T$     .. TYPE OF COIN                 I
I  N      .. NUMBER MINTED (MILLIONS)     I
I  C$     .. CONDITION                    I
I  P$     .. PURCHASE DATE                I
I  Q      .. QTY OWNED                    I
I  C      .. COST                         I
I  V      .. VALUE                        I
I  C1     .. TOTAL COSTS                  I
I  V1     .. TOTAL VALUE                  I
I  X$     .. ITEM TO SEARCH FOR           I
I-----------------------------------------I

     FUNCTIONS USED
I-----------------------------------------I
I NAME    .. DESCRIPTION                  I
I-----------------------------------------I
I  TAB    .. FORMATS PRINT LINES          I
I-----------------------------------------I
```

Sample Data – Version Two

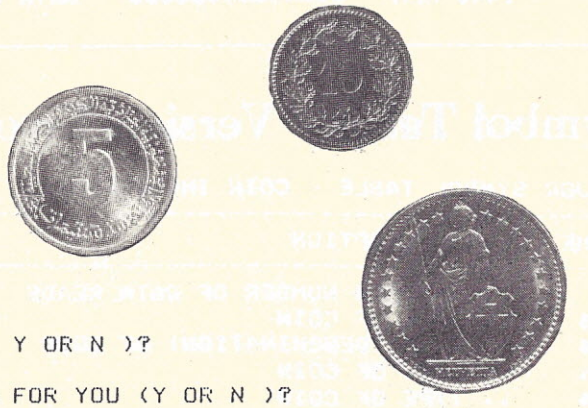
```
1450 DATA 1947,.25,D,WASHINGTON,10,VF,DEC 1978,1,1.50,1.50
1460 DATA 1944,.05,S,SILVER,11.1,VG,JAN 1979,50,1.50,1.75
1470 DATA 1965,.10,D,FLAW,114.1,F,FEB 1979,1,10,11.50
1480 DATA 1978,M,S,PROOF SET,3.2,PR,OCT 1978,10,7.00,17.50
1490 DATA 1978,M,S,MINT SET,4.50,BU,OCT 1978,10,4.00,14.00
1500 DATA 1945,.05,D,SILVER,16.47,VF,JUL 1978,100,.40,.55
1510 DATA 1907,.01,,INDIAN,.35,G,AUG 1979,1000,.75,.80
1520 DATA 1901,.01,,INDIAN,.86,G,SEP 1979,2000,.75,.80
1530 DATA 1875,1.00,CC,,65.17,G,SEPT 1979,1,65,75
1540 DATA 1945,.25,S,WASHINGTON,8.89,F,SEP 1979,5,1.75,2.10
1550 DATA END
```

Sample Output – Version Two

```
RUN
SHALL I PRINT ALL OF THE ENTRIES ( Y OR N )?
? Y
SHALL I PRODUCE TOTAL COSTS/VALUES FOR YOU (Y OR N )?
? Y
```

DATE	SIZE	COND	TYPE	NBR (MIL)	PRCH	QTY	COST	VALUE
1947D	.25	VF	WASHINGTON	10	DEC 1978	1	1.5	1.5
1944S	.05	VG	SILVER	11.1	JAN 1979	50	1.5	1.75
1965D	.10	F	FLAW	114.1	FEB 1979	1	10	11.5
1978S	M	PR	PROOF SET	3.2	OCT 1978	10	7	17.5
1978S	M	BU	MINT SET	4.5	OCT 1978	10	4	14
1945D	.05	VF	SILVER	16.47	JUL 1978	100	.4	.55
1907	.01	G	INDIAN	.35	AUG 1979	1000	.75	.8
1901	.01	G	INDIAN	.86	SEP 1979	2000	.75	.8
1875CC	1.00	G		65.17	SEPT 1979	1	65	75
1945S	.25	F	WASHINGTON	8.89	SEP 1979	5	1.75	2.1

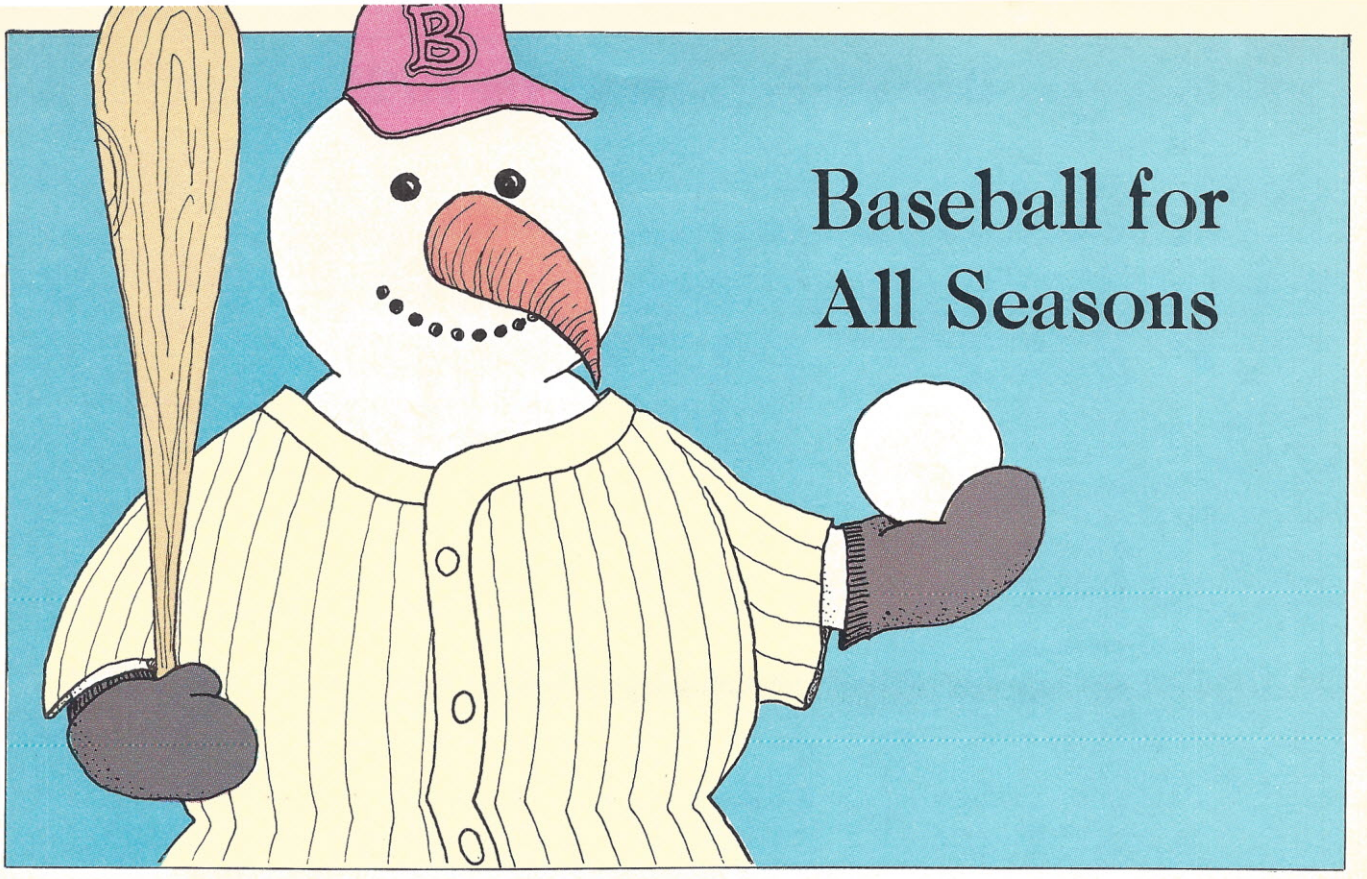
```
**************************
  TOTAL COST WAS  2560.25
**************************
  TOTAL VALUE IS    2956
**************************


BREAK IN 1430
```



```
RUN
SHALL I PRINT ALL OF THE ENTRIES ( Y OR N )?
? N
SHALL I PRODUCE TOTAL COSTS/VALUES FOR YOU (Y OR N )?
? N
WHAT SHALL I SEARCH FOR: DATE(D),  DENOMINATION SIZE (S)
                         MINT (M), OR TYPE (T)?
? D
ENTER THE DATE TO SEARCH FOR
? 1945
```

1945	SIZE	COND	TYPE	NBR (MIL)	PRCH	QTY	COST	VALUE
D	.05	VF	SILVER	16.47	JUL 1978	100	.4	.55
S	.25	F	WASHINGTON	8.89	SEP 1979	5	1.75	2.1

```
BREAK IN 1430
```



Baseball for All Seasons

BY LEONARD S. MAGERMAN

Play baseball when the regular season is over? You can with this compact little program written for an HP25. An accompanying flow chart shows the logic flow. Using the flow chart, the program can be converted to a T.I. or similar programmable calculator.

This is a two-player game. Each player takes a turn at bat while the other pitches. The batter has a choice of swinging or taking the pitch entered (which is automatically masked by a string of . . . 5s). The pitcher has a choice of three pitches: change up, fast or curve ball, each of which has been assigned the following probabilities:

Key	Pitch	Pitch Taken		Pitch Swung On	
		P(Ball)	P(Strike)	P(Hit)	P(Strike)
1	Fast Ball	25%	75%	25%	75%
2	Curve Ball	50%	50%	50%	50%
3	Change Up	75%	25%	75%	25%

Calculations of put outs, singles, doubles, triples and home runs are based on probabilities derived from the 1972 National League statistics for those parameters. These probabilities are applied whenever a ball is "hit."

The following table lists the displays along with the probabilities associated with each parameter:

Action	Display	Probability	Storage Register
Out	0	.699	$R_4 = .699$
Single	1	.212	$R_5 = .911$
Double	11	.045	$R_6 = .956$
Triple	111	.007	$R_7 = .963$
Home Run	1111	.037	———
Strike	5	Depends on Pitch	
Ball	8	Depends on Pitch	

Note that the probabilities in the storage registers are cumulative and can be changed to suit. In fact, for a high scoring game use the following values in registers 4, 5, 6, and 7:

$$R_4 = .4; R_5 = .7; R_6 = .85; R_7 = .90.$$

To begin the play of the game, key the program into the calculator and proceed as follows:

1. Store random number seed	0 to 1 — STO0	
2. Store random number range	4 — STO1	
3. Store swing indicator	55555 — STO3	
4. Store action probabilities		Alternate
P(Out)	.699 — STO4	.40
P(Out & Single)	.911 — STO5	.70
P(Out & Single & Double)	.956 — STO6	.85
P(Out & Single & Double & Triple)	.963 — STO7	.90
5. Initialize	fFIX 0, fPRGM	
6. Key in Pitch	1, 2 or 3 — R/S (Display shows . . . 5s)	
7. Key in Swing	0 or 1 — R/S	

8. Repeat steps 6 & 7 switching batting & pitching roles after every 3 outs.

Because the program was written for the HP25, it is limited to 49 steps. However, one will find that these 49 steps have enough complexity to provide an interesting and challenging contest for two players.

Of course, with more programming steps, one can revise the game to include double plays, automatic scoring, incorrect input displays and so forth. □

Illustration by Mark Sewell

Baseball Program for the HP25

LINE NO	KEY CODE	KEY ENTRY	COMMENTS
00			Key in pitch
01	24 01	RCL 1	
02	24 00	RCL 0	Ran # 1 seed
03	23 51 02	STO+2	Ran # 2 = old seed
04	15 73	g Pi	Start Ran # 1 generation
05	51	+	
06	05	5	
07	14 03	f Y^X	
08	15 01	g FRAC	
09	23 00	STO 0	Store Ran # 1 seed
10	61	X	Ran # 1
11	24 03	RCL 3	Display swing indicator
12	74	R/S	Key in swing
13	21	x><y	Exchange x & y
14	22	Roll	
15	15 71	g x=0	
16	13 44	GTO 44	True-Take pitch
17	22	Roll	False-Swing
18	14 41	f x<y	
19	13 47	GTO 47	True-Strike
20	24 02	RCL 2	False-Ball contact
21	15 01	g FRAC	
22	24 04	RCL 4	
23	14 51	f x>=y	
24	13 42	GTO 42	True-Out
25	22	Roll	False-Single or better
26	24 05	RCL 5	
27	14 51	f x>=y	
28	13 40	GTO 40	True-Single
29	22	Roll	False-Double or better
30	24 06	RCL 6	
31	14 51	f x>=y	
32	13 39	GTO 39	True-Double
33	22	Roll	False-Triple or better
34	24 07	RCL 7	
35	14 51	f x>=y	
36	13 38	GTO 38	True-Triple
37	01	1	False-Display 1111=Homer
38	01	1	Display 111=Triple
39	01	1	Display 11=Double
40	01	1	Display 1=Single
41	13 00	GTO 00	
42	00	0	Display 0=Out
43	13 00	GTO 00	
44	22	Roll	
45	14 41	f x<y	
46	13 49	GTO 49	True-Ball
47	05	5	False-Display 5=Strike
48	13 00	GTO 00	
49	08	8	Display 8=Ball

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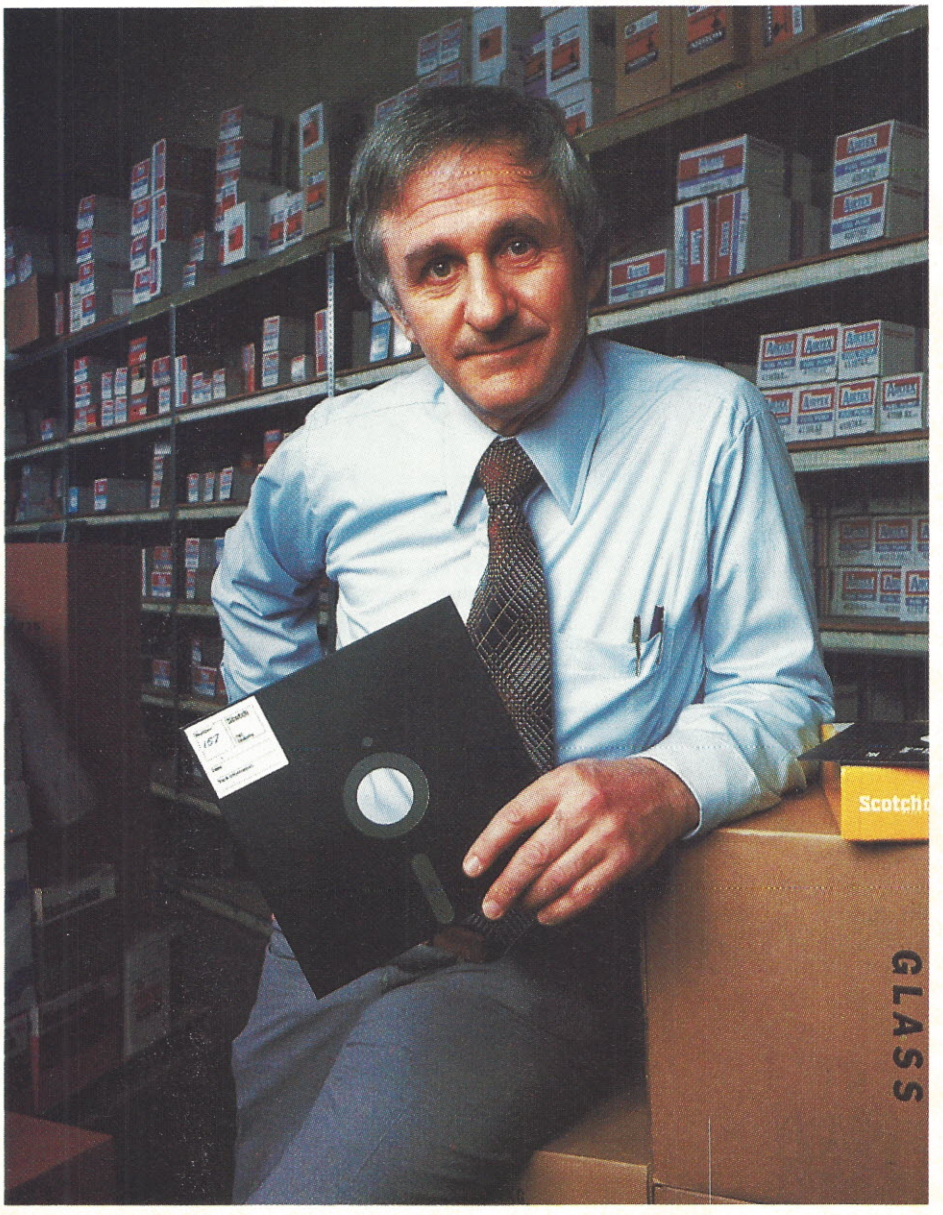

Don Stone, President, Mass. Auto Supply Company, Inc., Boston, Mass.

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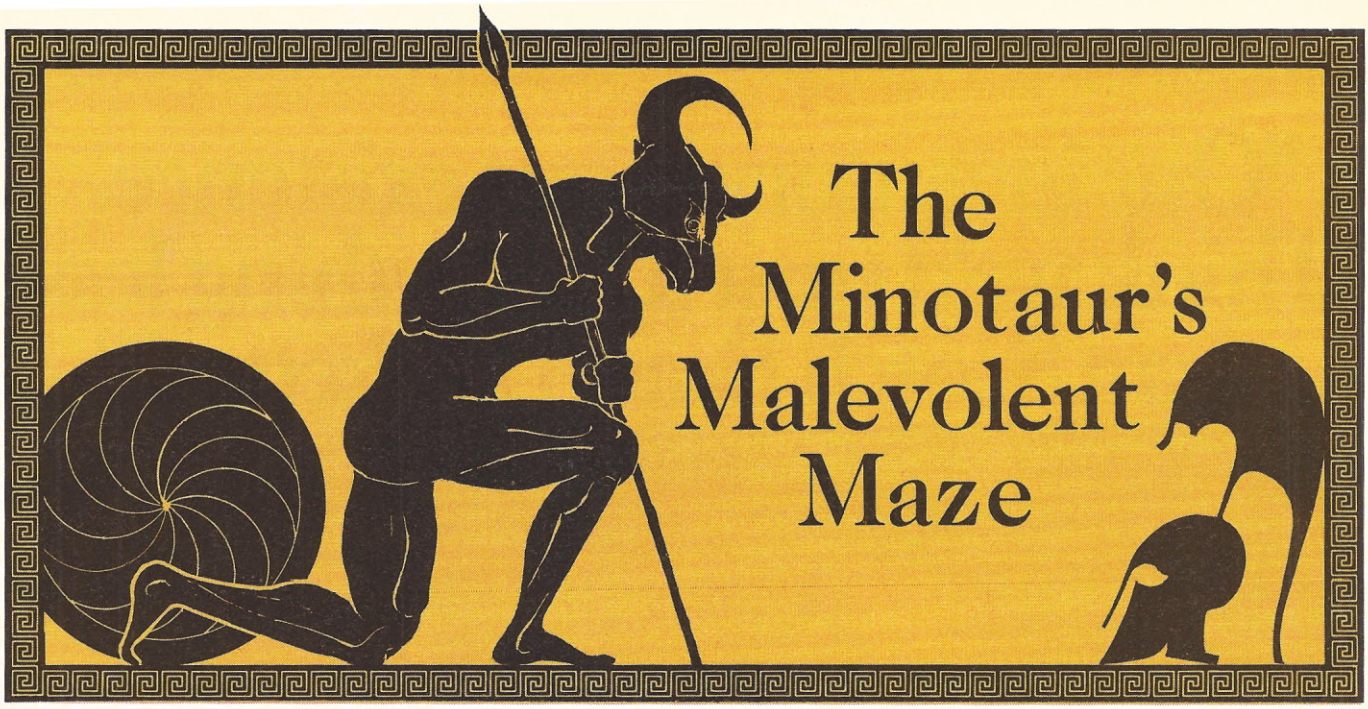


The Minotaur's Malevolent Maze

BY DAVID LAPPEN

Most mazes lack excitement because they're too static. As long as you follow the right or left wall of a solvable maze, sooner or later you'll find yourself emerging at the exit.

But the Minotaur's Malevolent Maze is dynamic; as you proceed from start to finish new walls are added randomly to force you to change your strategy. A game of luck, skill, timing and concentration, it was designed to fit easily into a 4K TRS-80.

You start the game as a "*" in the upper left-hand corner of a box — the biggest rectangle the screen will display. A starting number of blocks or walls are put in the maze. Your job is to get to the finish box in the lower right-hand corner before all your paths are blocked. You change direction of motion by depressing one of the keyboard arrows for up, down, left and right. Hitting the space bar stops motion. You will continue moving in the same direction until you hit a wall, enter a new direction, or win the game. A new wall is added each time the * moves or could move if a wall was not in its way or the space bar (no motion) was not the last motion command entered. If you find that you have no paths left to the finish box, you can concede the game by hitting the "Q" key.

Statistics on your progress are displayed between games. If you win, the number of starting walls is increased; if you lose it is decreased. Statistics include the number of starting walls on the next game, your average number of starting walls (including the next game), the highest number of starting walls on a game you won and whether this high was set on the game you just finished. Another statistic, the number of walls added since the start of the game, is displayed in the center island during the game.

Before the first game starts, you have two options. The first is whether the game should commence as soon as the maze is set up (indicated by printing your * in the starting position) or whether the game should start only after your first move is entered. The beginner should have the game wait to allow time to evaluate the board and set an initial strategy. A more advanced player will want the added challenge of a game with even the initial strategy formulated "on the fly".

The second option involves determining how many initial walls you want on your first game. Since the program adjusts the number of walls depending on how well you do, this option just gives the program an idea of where to start. I suggest a starting value of forty walls for beginners.

This game was designed for the Radio Shack TRS-80, but can be converted easily to other machines. The key to understanding the game is to understand the INKEY$, PEEK and POKE commands. These commands allow the game to be played interactively (which, although not absolutely necessary, adds quite a lot), and to execute quickly in a small memory space.

INKEY$ checks an input buffer to see if anything has been entered from the keyboard since the last time it was checked. It does not require a carriage return (enter), nor does it print anything on the screen or affect the cursor position. If nothing has been entered, the command returns a null character. Therefore, to get the regular input command, which waits for the input before continuing program execution (minus the carriage return), you would substitute

```
10 A$=INKEY$
15 IF A$ = "" GOTO 10
```

for 10 INPUT A$.

Remember that the INKEY$ command accepts only one character.

PEEK and POKE allow you to examine or change the contents of a particular memory location. What is put in or returned is either a number, an ASCII representation of an alphabetic character, or a Radio Shack representation of a graphics character. The video display memory starts at RAM location 15360 decimal and has 64 characters per line (0-63) for 16 lines. It is therefore straightforward to calculate the memory location which corresponds to a particular position on the screen. For "*" movement we need only check the

Illustration by David Bastille

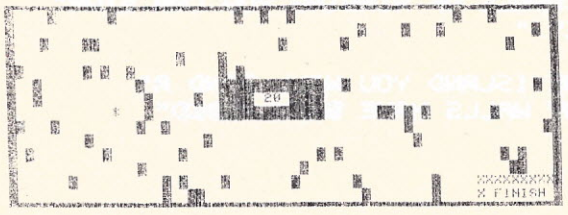
position that the "*" will be moving to. As long as that memory location holds only a 32 or 88 (ASCII space and "X", respectively) we allow motion. In the latter case the player has won since the finish box is surrounded by "X"s. For creating new walls, all we need to do is check that there is a 32 (space) at the proposed position.

If your particular machine has no way to examine what is at a specific screen position, you may have to keep an array with an element for each video location. With proper array management, where only empty positions are kept, this can increase the speed with which new walls are added since a random array subscript which is in bounds will always map onto an available place. Unfortunately, this array management consumes considerable time and memory space and therefore should be avoided if possible.

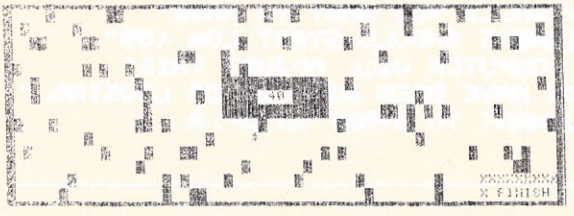
In this program, a random location is selected and, if occupied, another is selected until a vacant position is found. It's my experience that using this method gives no significant slowdown of game action until way after the point where all paths are closed off. Therefore I suggest that if direct ways of checking a memory location are not available in your BASIC, you link to the assembler for this very easy subroutine. Then all you will have to do is consult a memory map or do a one-time memory search for the location of your video screen memory.

Finally, I would like to propose a different use for this game. I think it could be used very effectively as a motivator tacked onto a teaching program. The maze could be made two lines shorter and these lines could be used for communication. If a student answers a question correctly he could be allowed perhaps five moves on the maze which is no longer interactive. Otherwise perhaps five walls could be added. □

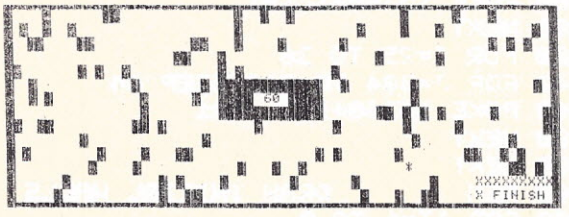
1. This game has been set up, but play has not yet commenced. Note the initial walls, the starting "*" and the finish box.



2. This game has been started but is in the beginning stage. There are still paths open both over the top and under the bottom of the center island. Twenty possible moves have gone by and twenty walls have been added since the start of the game.



3. Same game — 40 moves have gone by.



4. Same game — 60 moves have gone by. Almost at the Finish.

Program Notes

Variable Desciption

A	Current Game — number of starting walls
A1	Number of walls added since start of game
B$	Yes= First move starts game No= Game starts when set-up complete
C	Flag to indicate new high
D	What is on screen at proposed position of *
GA	Number of games played
GT	Grand total of starting values for all games played
HI	Highest winning value
N	Current position of *
NT	Proposed new position for *
R	ASCII value of valid input
TE	What is on video screen at proposed position of new wall

ASCII or Radio Shack Code

91	↑
10	↓
9	→
8	←
32	Space
88	X
191	■
131	□
176	▬

PEEK: Returns value of memory location specified. On Radio Shack machine, the video memory starts at location 15360 and is arranged in 16 lines of 64 characters.

POKE: Places second operand into the memory location indicated by first operand.

IF blocks: Remember that the Radio Shack machine executes instructions which follow and are on the same line as an IF statement (separated by ":") only when the IF is true.

Multi Statement lines: On the Radio Shack machine these are executed as if they had been arranged on separate lines. Statements are separated by ":".

Wait Loop, lines 8160-8170: Adjust FOR loop value to make game run faster or slower. Present value (100) seemed best to me.

Program Listing

```
10 REM MAZE- DAVID LAPPEN - NOV 24, 1978
11 DEFINT A-Z
13 CLS
14 PRINT"   WELCOME TO THE GAME OF MAZE.  LIKE AN ORDINARY GAME OF"
18 PRINT"MAZE, YOU MUST TRY TO GET FROM THE STARTING POINT (YOU ARE"
22 PRINT"THE '*' IN THE UPPER LEFT HAND CORNER) TO THE FINISH WHICH"
26 PRINT"IS LOCATED IN THE LOWER RIGHT HAND CORNER).  YOU WIN WHEN"
30 PRINT"YOU HIT A WALL ON THE FINISH BOX.  ALSO LIKE AN ORDINARY"
34 PRINT"MAZE, THE WALLS, OR BLOCKS STOP YOUR PROGRESS.  BUT IN THIS"
38 PRINT"GAME, THE MAZE IS CONSTANTLY GETTING MORE DIFFICULT IN"
42 PRINT"WALLS ARE ADDED RANDOMLY AS YOU MOVE.  THEREFORE PATHS"
46 PRINT"ARE CONSTANTLY BEING CLOSED OFF AND YOUR STRATEDGY MUST"
50 PRINT"CHANGE AS THE GAME PROGRESSES. "
54 PRINT""
58 PRINT"   BEFORE THE GAME STARTS YOU WILL BE GIVEN A CHOICE"
62 PRINT"WHETHER YOU WANT THE GAME TO START IMMEADIATELY AFTER IT"
66 PRINT"IS SET UP OR IF YOU WANT TO START THE GAME BY MAKING"
70 PRINT"YOUR FIRST MOVE.  IT IS EASIER TO WAIT SO THAT YOU CAN SET"
74 PRINT"A STRATEGY.  <TO CONTINUE INSTURCTIONS HIT ANY KEY>";
78 A$=INKEY$
82 IFA$="" GOTO 78
86 CLS
90 PRINT"   MOTION IS ACCOMPLISHED BY HITTING THE APPROPRIATE DIRECTION"
94 PRINT"ARROW.  FOR EXAMPLE TO MOVE UP HIT 'I'.  MOTION WILL CONTINUE"
98 PRINT"IN THE DIRECTION OF THE LAST ENTRY UNTIL THE GAME IS WON, "
102 PRINT"A WALL, BOUNDRY, OR THE ISLAND IS HIT, OR YOU ENTER A NEW"
106 PRINT"DIRECTION.  TO STOP THE MOTION, YOU CAN HIT THE SPACE BAR. "
110 PRINT"IF YOU FIND THAT YOU HAVE NO CHANCE OF WINNING YOU CAN STOP"
114 PRINT"THE GAME BY HITTING THE '@' KEY. "
116 PRINT""
118 PRINT"  FINALLY, IN THE MIDDLE OF THE ISLAND YOU WILL FIND A"
122 PRINT"COUNTER.  IT TELLS YOU HOW MANY WALLS HAVE BEEN ADDED"
126 PRINT"SINCE THE GAME BEGAN. "
335 PRINT
336 C=0
337 GA=1
338 HI=0
340 INPUT"DO YOU WANT TO LOOK AT THE MAZE BEFORE THE GAME STARTS";B$
350 B$=LEFT$(B$,1)
360 IF B$="Y" PRINT "ENTER YOUR FIRST MOVE TO START GAME. "
361 FOR I=1 TO 8
362 PRINT""
363 NEXT
365 PRINT"YOU NOW GET TO SELECT HOW MANY WALLS YOU WANT TO HAVE"
366 PRINT"AT THE START OF THE GAME.  BEGINNERS SHOULD START LOW (50"
367 PRINT"PERHAPS).  IN LATER GAMES THE COMPUTER WILL ADJUST THIS"
368 PRINT"NUMBER ACCORDING TO WHETHER YOU HAVE BEEN WINNING OR LOOSING. "
369 PRINT"":INPUT "HOW MANY WALLS DO YOU WANT TO START WITH";A
370 GT=A
380 CLS
385 PRINT @ 65, CHR$(128);
390 N=65
395 REM          DRAW FINISH BOX
400 PRINT @ 886,"XXXXXXXXX";
700 PRINT @ 950,"X FINISH";
750 REM          DRAW BOUNDRY
800 FOR I=0 TO 63
900 POKE 15360+I,176
1000 NEXT
1400 FOR I=127 TO 959 STEP 64
1440 POKE 15360+I,191
1460 NEXT
1500 FOR I=1023 TO 960 STEP -1
1600 POKE 15360+I,131
1700 NEXT
2000 FOR I=896 TO 64 STEP -64
2100 POKE 15360+I,191
2200 NEXT
2420 FOR I=25 TO 36
2440 FOR J=384 TO 512 STEP 64
2460 POKE 15360+I+J, 191
2480 NEXT
2500 NEXT
5000 REM          DRAW INITIAL WALLS
5100 FOR IT=1 TO A
```

```
5200 GOSUB 20000
5300 NEXT IT
5340 REM         DRAW PLAYER'S PIECE
5350 PRINT @ 65, "*";
5400 A1=0
5405 R=32
5407 REM         WAIT IF FIRST MOVE STARTS PLAY
5410 A$=INKEY$
5430 IF B$="N" GOTO 5500
5450 A$=INKEY$:IF A$="" GOTO 5450
5470 GOTO 5510
5500 A$=INKEY$
5510 PRINT @ 477, A1;
5550 NT=0
5560 REM         IF NO NEW MOVE IS ENTERED, KEEP OLD MOVE
5565 REM         OTHERWISE UPDATE DIRECTION OF MOTION
5570 IF A$="" GOTO 5900
5575 R=ASC(A$)
5600 IF A$="Q" A=A*.8: GOTO 13050
5700 IF R<>91 AND R<>10 AND R<>9 AND R<>8 AND R<>32  GOTO 5900
5900 IF R=91 NT=N-64
6000 IF R=10 NT=N+64
6100 IF R=9 NT=N+1
6200 IF R=8 NT=N-1
6220 IF R=32 GOTO 8150
6230 REM         LOOK AT PLACE WANT TO MOVE TO SEE IF ANYTHING
6233 REM         IS THERE.   IF BLANK, MOVE PIECE.  IF =X, HAVE
6235 REM         WON GAME.  IF IS A WALL KEEP PLAYER STILL.
6250 D=PEEK(15360+NT)
6300 IF D<>88 AND D<>32 GOTO 8150
6400 PRINT @ N," ";
6500 PRINT @ NT,"*";
6600 N=NT
6700 IF D=88 GOTO 10000
8150 GOSUB 20000
8160 FOR IU=1 TO 100
8170 NEXT
8200 GOTO 5500
9999 REM         PLAYER WINS SECTION
10000 PRINT @951,"YOU WIN";
10040 IF A>HI THEN C=1:HI=A
10100 A=A*1.2
10150 REM        END GAME BOARD DISPLAY WAIT LOOP
10200 FOR I=1 TO 800
10300 NEXT I
13000 REM        PRE-NEW-GAME STATISTICS
13050 CLS
13060 GA=GA+1
13070 PRINT "YOU START WITH ";A;" BLOCKS";
13080 PRINT""
13081 PRINT""
13082 GT=GT+A
13085 PRINT "YOUR AVERAGE STARTING NUMBER IS ";GT/GA
13086 PRINT""
13087 PRINT""
13088 PRINT"YOU HIGHEST STARTING VALUE IS ";HI
13093 IF C=1 PRINT"":PRINT"":PRINT"YOU HAVE JUST REACHED A NEW HIGH!"
13100 FOR I=1 TO 3000:NEXT
14000 C=0
15000 GOTO 380
19999 REM        DRAW WALL SUBROUTINE
20000 IR=RND(950)
20100 TE=PEEK(15359+IR)
20150 IF TE<>32 GOTO 20000
20180 A1=A1+1
20200 POKE 15359+IR,191
21300 RETURN
```

BASIC Renumbering

BY CHARLES K. BALLINGER

Changing your program line numbers is a tedious and painful task. Unfortunately, it is often necessary to avoid a fragmented and messy final program, or to insert additional lines between consecutive line numbers. This BASIC Renumbering program will relieve you of this unpleasant chore while converting approximately 95% of your program statements.

After checking my BASIC I found that only the following statements could be followed by a statement number: GOTO, GOSUB, THEN and ON. Therefore, the program must scan for these words and convert the statement number following them.

The program passes the input file twice. On the first pass the old sequence number is read and stored and the new sequence number computed and stored in the Dimension S. On pass two, the file is read and then converted and written to the new output file.

Statements 740 to 800 convert the number to a character string with leading zeroes since Heath's HDOS BASIC will not allow a blank to appear as the first character encountered. If your BASIC does not have this restriction you may remove this code to reduce program size.

Statements 1030 to 1080 break the input line into three parts: the new sequence number; the data between the sequence number and the word scanned for; and the referenced statement number. Because the program only allows three separate character strings, multiple statements per line are not supported. You could modify the program to allow more strings at the cost of a larger program.

Statement 1030 returns the length of the BASIC statement read. Statement 1040 computes C1 to be equal to the total length of the string minus the position count where the match took place. Statement 1050 computes T1 as being equal to the total length of the string minus 6 minus the position count where the match took place — the length of "B" in Example 1. Statement 1070 converts the new sequence number to a string and places the value in variable F$.

Statement 1080 then combines string D$ (the new sequence number) with P$ (equal to "B" in Example 1) and F$ (the new referenced number) to form string variable Z$, which is written as the new output record.

Example 1

```
00120    IF C = 0 THEN    820
  A           B             C
```

While this program will convert approximately 95% of your statements, the following conditions must be observed:

- No multiple statements on one line.
- The ON X 120, 150, 200 statement is not supported, but you will be informed by the program of the statement number that must be hand-changed.
- The statement IF C = 0 THEN PRINT "EXAMPLE" will not convert correctly, but a minor change in program logic will correct this omission.

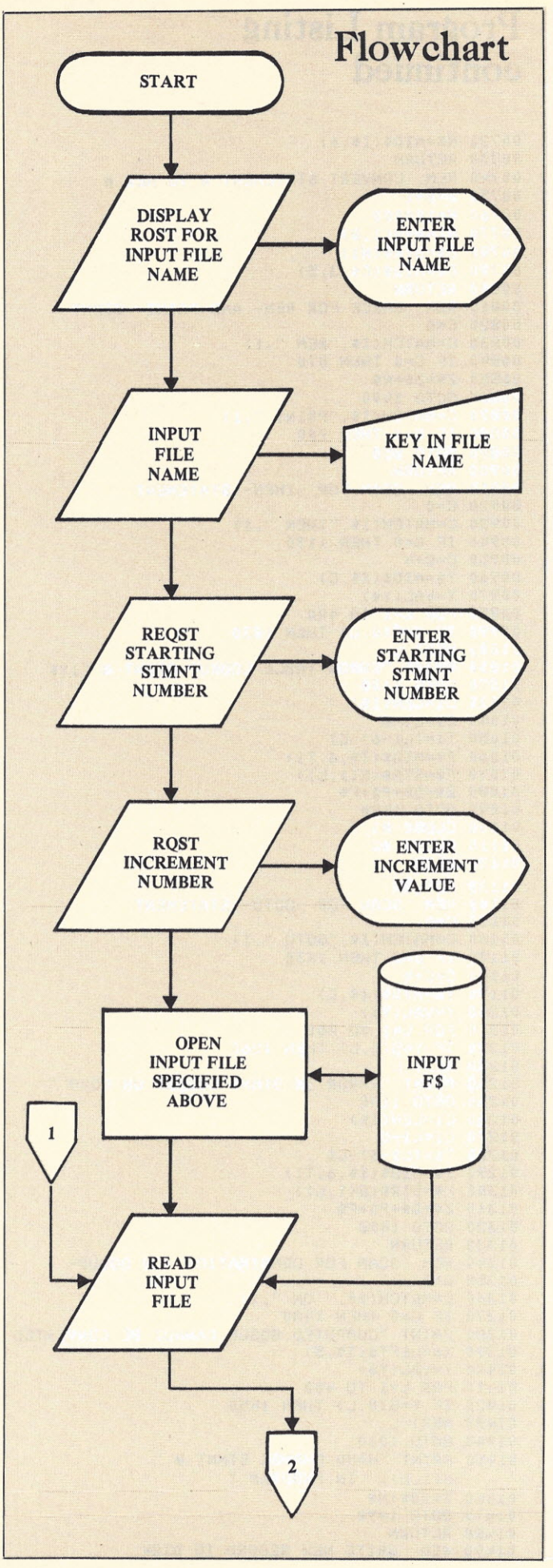
Not incorporating some of these features in the initial program minimizes the core requirements for people who don't have sufficient memory. The program currently requires approximately 3K of core for program text and another 5K for the dimension, file buffers and other variables. If you find you don't have sufficient memory to run this program, change the dimension by changing statements 110, 230, 980, 1410 and 1670 to whatever dimension size you choose.

When run against a 192 statement program, this program required 50 seconds to complete pass one and 7 minutes to complete pass two.

The program was written on an H-8 computer configured to 36K with dual mini-floppy drives. □

Special Functions Used

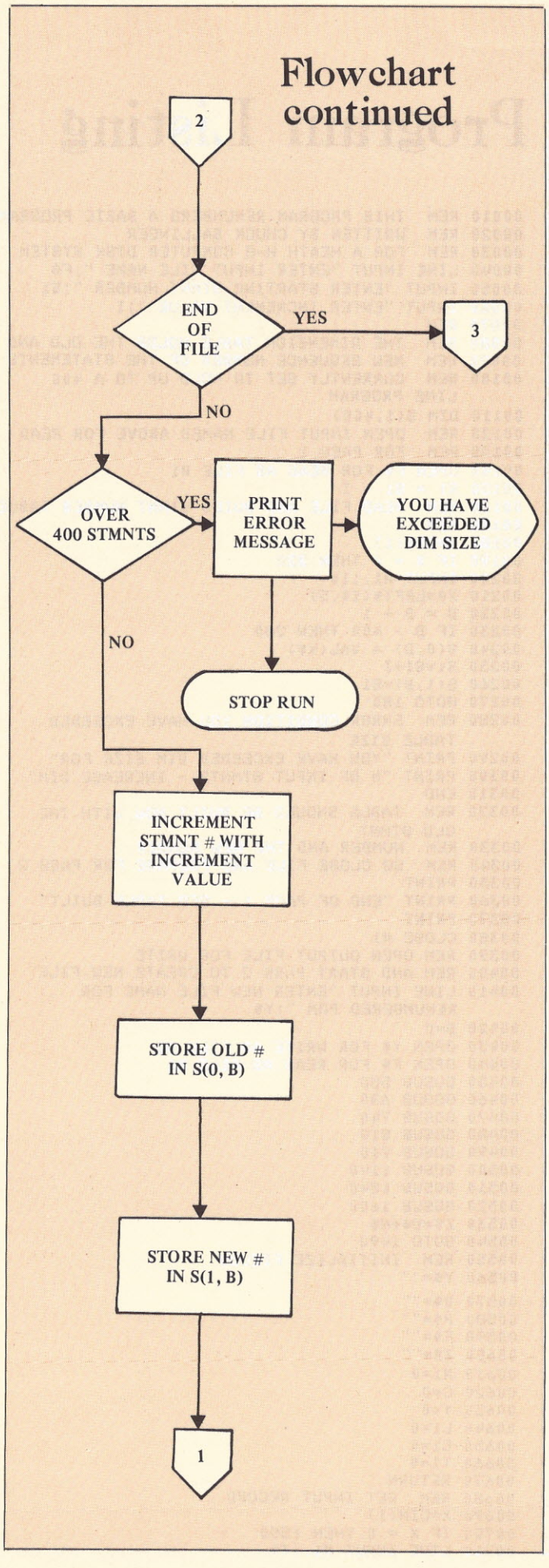
STR$(narg)	The string function encodes the numeric argument into ASCII format.
LEFT$(sexp,iexp)	Left string function returns the string value identified by (sexp) for the number of bytes specified by (iexp).
LEN(sexp)	The length function returns a numeric value that is the number of bytes in the string.
MATCH(sexp1,sexp2,iexp)	The match function searches (sexp1) for any substring matching (sexp2) starting with the position specified by (iexp). A value of zero (0) is returned if no match is found.
MID$(sexp,iexp1,iexp2)	The middle function returns the right-handed substring of (sexp) starting in position (iexp1) for (iexp2) characters or to the end of the string if (iexp2) is omitted.
VAL(sexp)	The numeric function returns the numeric value of a number encoded in a string.
CIN(x)	This function checks the channel specified by (x). Its purpose in this program is to detect an end-of-file on the input file.
LINE INPUT	This function allows string data to be inputted without being enclosed in quotes.



Program Listing

```
00010 REM  THIS PROGRAM RENUMBERS A BASIC PROGRAM
00020 REM  WRITTEN BY CHUCK BALLINGER
00030 REM  FOR A HEATH H-8 COMPUTER DISK SYSTEM
00040 LINE INPUT "ENTER INPUT FILE NAME ";F$
00050 INPUT "ENTER STARTING STMNT NUMBER ";S1
00060 INPUT "ENTER INCREMENT VALUE ";I
00070 REM
00080 REM  THE DIMENSION TABLE HOLDS THE OLD AND THE
00090 REM  NEW SEQUENCE NUMBER OF THE STATEMENTS
00100 REM  CURRENTLY SET TO HOLD UP TO A 400
      LINE PROGRAM
00110 DIM S(1,400)
00120 REM  OPEN INPUT FILE NAMED ABOVE FOR READ
00130 REM  FOR PASS 1
00140 OPEN F$ FOR READ AS FILE #1
00150 S1 = S1 - I
00160 REM  READ FILE AND BUILD STMNT NUMBER TABLE
00170 REM
00180 X=CIN(1)
00190 IF X = 0 THEN 320
00200 INPUT #1,;I$
00210 X$=LEFT$(I$,5)
00220 B = B + 1
00230 IF B > 400 THEN 280
00240 S(0,B) = VAL(X$)
00250 S1=S1+I
00260 S(1,B)=S1
00270 GOTO 180
00280 REM  ERROR CONDITION YOU HAVE EXCEEDED
      TABLE SIZE
00290 PRINT "YOU HAVE EXCEEDED DIM SIZE FOR"
00300 PRINT "# OF INPUT STMNTS - INCREASE DIM"
00310 END
00320 REM  TABLE SHOULD BE BUILT NOW WITH THE
      OLD STMNT
00330 REM  NUMBER AND THE NEW NUMBER
00340 REM  SO CLOSE FILE AND PREPARE FOR PASS 2
00350 PRINT
00360 PRINT "END OF PASS 1 - SEQ TABLE BUILT"
00370 PRINT
00380 CLOSE #1
00390 REM OPEN OUTPUT FILE FOR WRITE
00400 REM AND START PASS 2 TO CREATE NEW FILE
00410 LINE INPUT "ENTER NEW FILE NAME FOR
      RENUMBERED PGM ";Y$
00420 B=0
00430 OPEN Y$ FOR WRITE AS FILE #2
00440 OPEN F$ FOR READ AS FILE #1
00450 GOSUB 550
00460 GOSUB 680
00470 GOSUB 740
00480 GOSUB 810
00490 GOSUB 910
00500 GOSUB 1140
00510 GOSUB 1340
00520 GOSUB 1600
00530 Z$=D$+N$
00540 GOTO 1490
00550 REM  INITIALIZE FIELDS
00560 Y$=""
00570 D$=""
00580 P$=""
00590 F$=""
00600 Z$=""
00610 N1=0
00620 C=0
00630 Y=0
00640 L1=0
00650 C1=0
00660 T1=0
00670 RETURN
00680 REM  GET INPUT RECORD
00690 X=CIN(1)
00700 IF X = 0 THEN 1550
00710 LINE INPUT #1,;I$
```

Flowchart continued

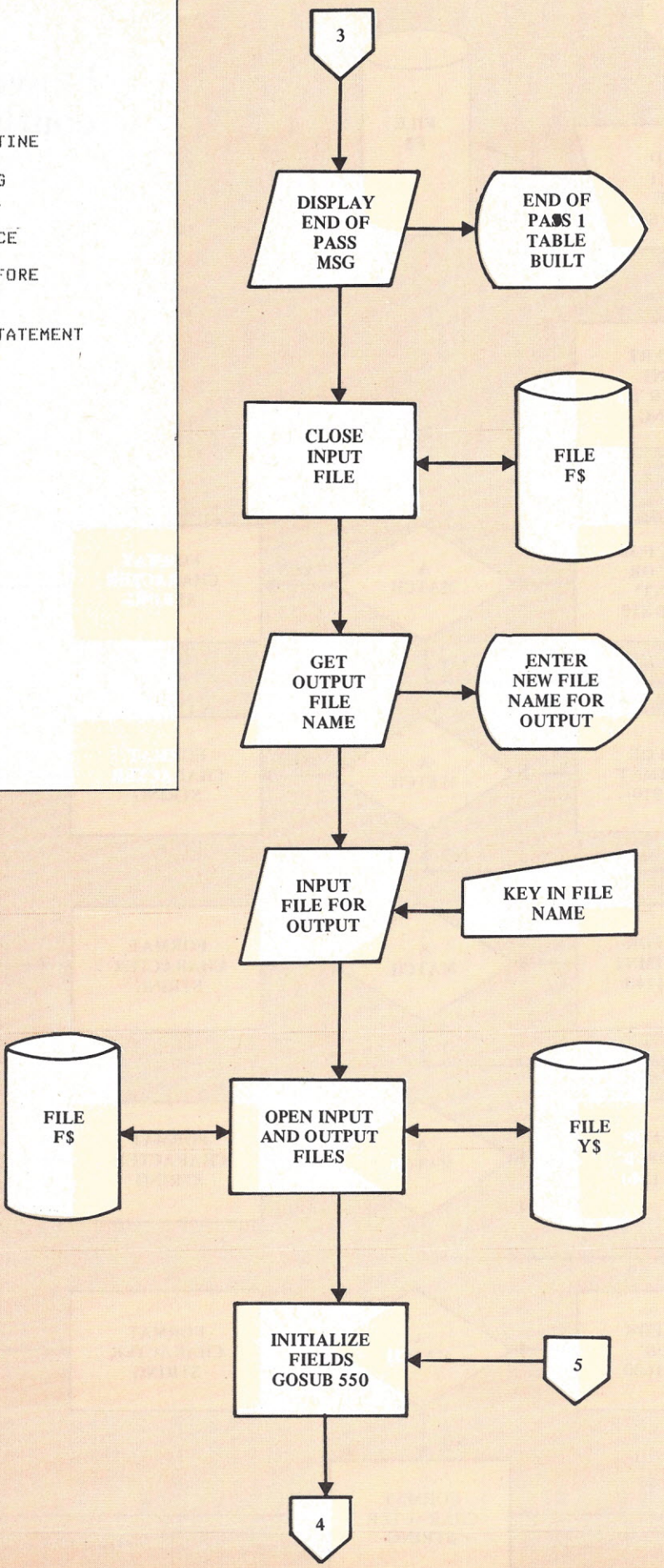


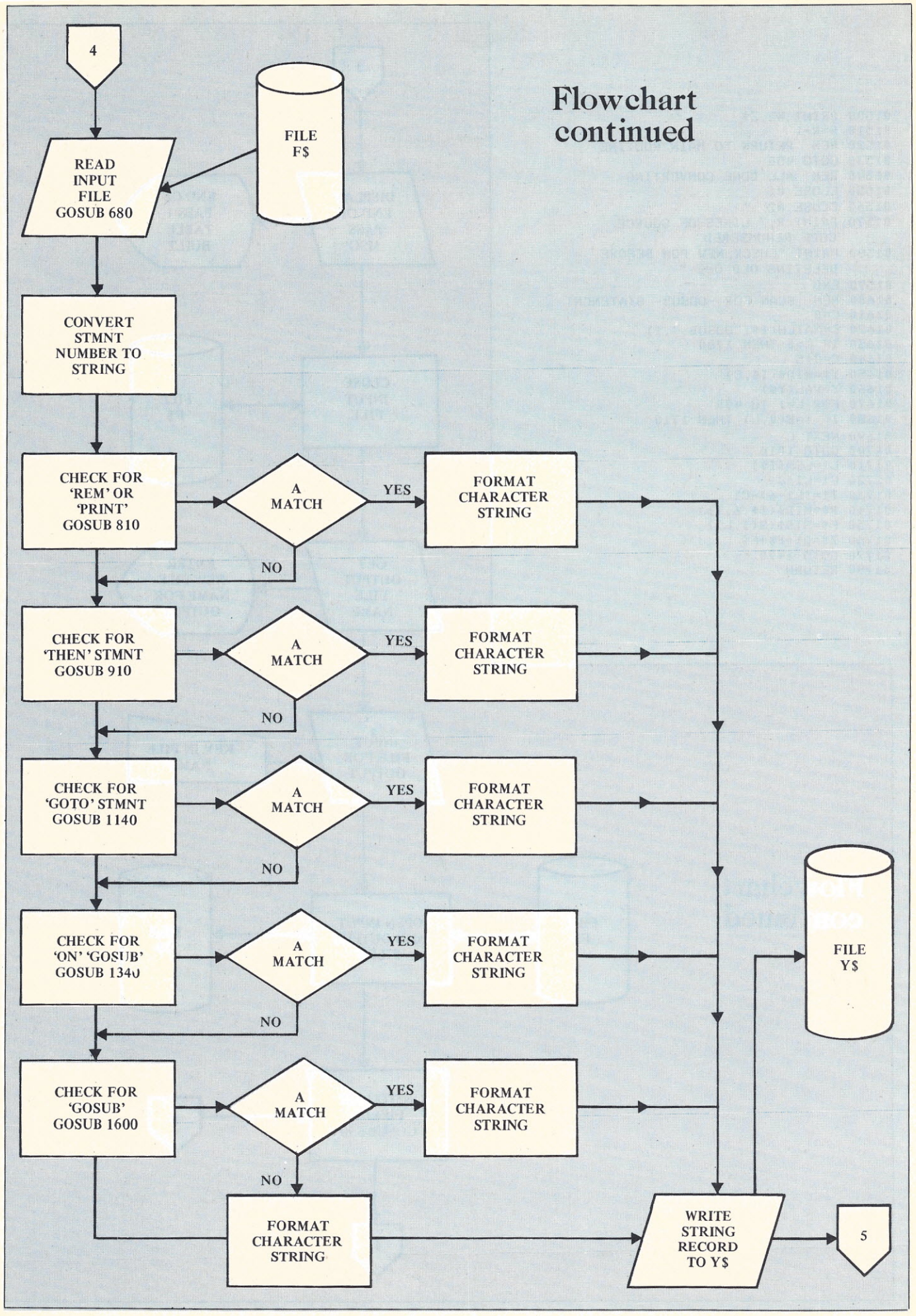
Program Listing continued

```
00720 N$=MID$(I$,6)
00730 RETURN
00740 REM  CONVERT STATEMENT # TO NEW #
00750 B=B+1
00760 N=100000
00770 N1=N+S(1,B)
00780 C$=STR$(N1)
00790 D$=MID$(C$,3,5)
00800 RETURN
00810 REM  CHECK FOR REM- AND PRINT- STMNT
00820 C=0
00830 C=MATCH(I$,"REM ",1)
00840 IF C=0 THEN 870
00850 Z$=D$+N$
00860 GOTO 1490
00870 C=MATCH(I$,"PRINT ",1)
00880 IF C=0 THEN 900
00890 GOTO 850
00900 RETURN
00910 REM  SCAN FOR -THEN- STATEMENT
00920 C=0
00930 C=MATCH(I$,"THEN ",1)
00940 IF C=0 THEN 1130
00950 C=C+4
00960 Y$=MID$(I$,C)
00970 Y=VAL(Y$)
00980 FOR L=1 TO 400
00990 IF Y=S(0,L) THEN 1030
01000 NEXT L
01010 PRINT "ERROR TABLE LOOKUP STMNT # ";Y$
01020 GOTO 1100
01030 L1=LEN(I$)
01040 C1=L1-C
01050 T1=(L1-6)-C1
01060 P$=MID$(I$,6,T1)
01070 F$=STR$(S(1,L))
01080 Z$=D$+P$+F$
01090 GOTO 1490
01100 CLOSE #1
01110 CLOSE #2
01120 STOP
01130 RETURN
01140 REM  SCAN FOR -GOTO- STATEMENT
01150 C=0
01160 C=MATCH(I$,"GOTO ",1)
01170 IF C=0 THEN 1330
01180 C=C+4
01190 Y$=MID$(I$,C)
01200 Y=VAL(Y$)
01210 FOR L=1 TO 400
01220 IF Y=S(0,L) THEN 1260
01230 NEXT L
01240 PRINT "ERROR IN STMNT LOOKUP ON GOTO "
01250 GOTO 1100
01260 L1=LEN(I$)
01270 C1=L1-C
01280 T1=(L1-6)-C1
01290 P$=MID$(I$,6,T1)
01300 F$=STR$(S(1,L))
01310 Z$=D$+P$+F$
01320 GOTO 1490
01330 RETURN
01340 REM  SCAN FOR COMBINATION -ON GOSUB-
01350 C=0
01360 C=MATCH(I$," ON ",1)
01370 IF C=0 THEN 1480
01380 PRINT "COMPUTED GOSUB CANNOT BE CONVERTED "
01390 Y$=LEFT$(I$,5)
01400 Y=VAL(Y$)
01410 FOR L=1 TO 400
01420 IF Y=S(0,L) THEN 1450
01430 NEXT L
01440 GOTO 1010
01450 PRINT "HAND CHANGE STMNT # "
      S(1,L);" IN PROGRAM "
01460 Z$=D$+N$
01470 GOTO 1490
01480 RETURN
01490 REM  WRITE NEW RECORD TO DISK
```

```
01500 PRINT #2,Z$
01510 R=R+1
01520 REM  RETURN TO MAIN ROUTINE
01530 GOTO 450
01540 REM  ALL DONE CONVERTING
01550 CLOSE #1
01560 CLOSE #2
01570 PRINT R;" LINES OF SOURCE
      CODE RENUMBERED"
01580 PRINT "CHECK NEW PGM BEFORE
      DELETING OLD ONE "
01590 END
01600 REM  SCAN FOR -GOSUB- STATEMENT
01610 C=0
01620 C=MATCH(I$,"GOSUB ",1)
01630 IF C=0 THEN 1780
01640 C=C+5
01650 Y$=MID$(I$,C)
01660 Y=VAL(Y$)
01670 FOR L=1 TO 400
01680 IF Y=S(0,L) THEN 1710
01690 NEXT L
01700 GOTO 1010
01710 L1=LEN(I$)
01720 C1=L1-C
01730 T1=(L1-6)-C1
01740 P$=MID$(I$,6,T1)
01750 F$=STR$(S(1,L))
01760 Z$=D$+P$+F$
01770 GOTO 1490
01780 RETURN
```

Flowchart continued




Flowchart continued
4
FILE F$
READ INPUT FILE GOSUB 680
CONVERT STMNT NUMBER TO STRING
CHECK FOR 'REM' OR 'PRINT' GOSUB 810
A MATCH
YES
NO
FORMAT CHARACTER STRING
CHECK FOR 'THEN' STMNT GOSUB 910
A MATCH
YES
NO
FORMAT CHARACTER STRING
CHECK FOR 'GOTO' STMNT GOSUB 1140
A MATCH
YES
NO
FORMAT CHARACTER STRING
CHECK FOR 'ON' 'GOSUB' GOSUB 1340
A MATCH
YES
NO
FORMAT CHARACTER STRING
CHECK FOR 'GOSUB' GOSUB 1600
A MATCH
YES
NO
FORMAT CHARACTER STRING
FORMAT CHARACTER STRING
WRITE STRING RECORD TO Y$
FILE Y$
5

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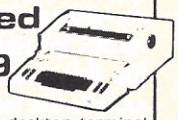

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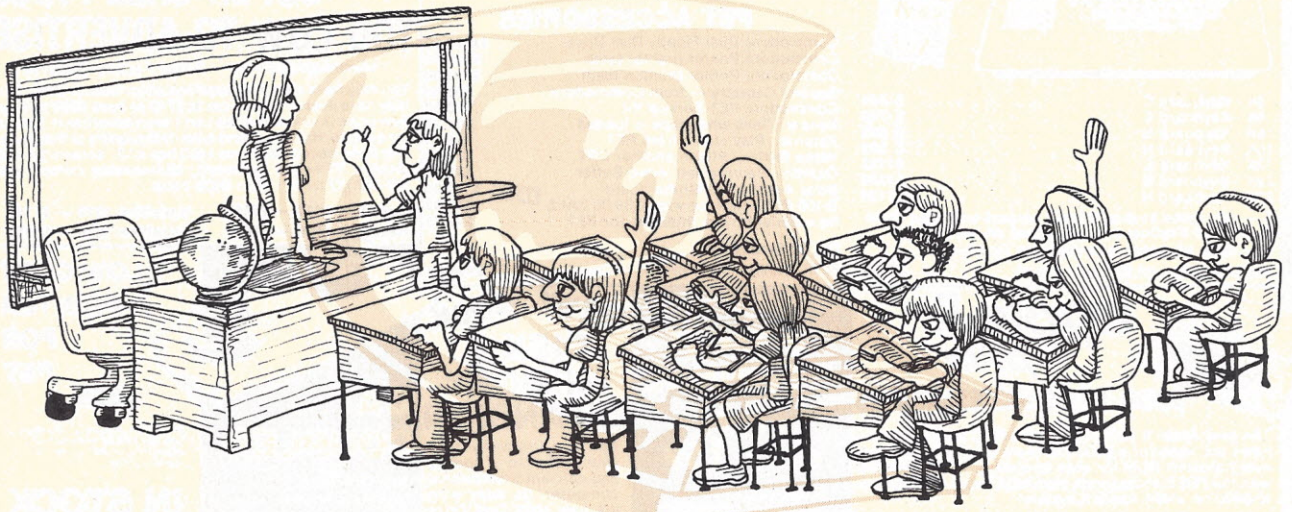
CIRCLE 13

The Computer Glass Box



BY HOWARD A. PEELLE

In the Computer Glass Box approach to teaching with *A Programming Language* (APL), short and quickly comprehensible computer programs are given to students for their direct viewing. Each program embodies a concept, procedure or relationship written simply and clearly. Since the inner workings of the programs are visible, they become the basis for learning.

This approach utilizes a computer program more as a "glass box" than a black box. By observing the structure of a program as well as its behavior, key concepts may become transparent to the student.

In contrast to conventional computer-assisted instruction (CAI), the glass box approach allows the student significant control over his own learning processes, achieved through programming. Programs can be entered independently by the student via a computer terminal, and their use requires no other pre-stored curriculum material, as do most CAI applications. Indeed, making the full power of the computer accessible to the learner is 180° from the kind of CAI characterized by programmed instruction, tutorial or drill-and-test sequences.

This approach suits a wide range of educational levels — from elementary school children to university graduate students. For children who have been held powerless in lock-step educational systems, the computer glass box opens up the world of *active* learning — learning with *power*.

Using glass box computer programs, students can:

- *examine* the program's definition (intuitively)
- *analyze* the program's definition (logically)
- *predict* the outcomes of the program
- *execute* the program on a computer
- *scrutinize* the program's behavior
- *experiment* with different applications of the program
- *modify* or expand the program
- *generalize* the program
- *invent* new or related programs,
- *discuss* implications with teachers and peers.

These student-initiated, student-responsible, success-oriented activities differ dramatically from the frantic hand-waving about abstract concepts often seen in classrooms.

The ideal glass box program "speaks" to its reader, explaining concepts and procedures in concrete terms. Desirable characteristics of such a program include simplicity, comprehensibility, flexibility, generality, elegance and provocative implications.

"Simplicity" means that a single idea of modest scope is to be taught using a brief program (about 10 lines of APL coding, taking less than 5 minutes to type). "Comprehensibility" means using clear, readable commands (usually one per line) with well-chosen mnemonic identifiers. "Flexibility" includes using a program design which is easily modified and is adaptable to other programs in modular structuring (nested sub-programs with explicit resultants). "Generality" is developing mathematical models which can extend to a class of cases. "Elegance" is choosing expressions which strike one's aesthetic chords. And, finally, a

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Illustration by Josh Randall

glass box program is "provocative" when its implications suggest interesting follow-up discussions.

Now, let's look at some examples of glass box programs.

Computer-Assisted Instruction

The first glass box program illustrated comes from the area of computer-assisted instruction. Instead of concealing the CAI program — usually designed to control the child's behavior - we show him the mechanism itself so that he may see how it works and ultimately control the computer.

Consider the following APL program, which exposes the essence of drill-and-practice in multiplication skills. In drill-and-practice, typically, a student is given a series of problems to solve and is asked for his answers. Then, the answers are evaluated. Indeed, the computer is an excellent vehicle for administering drill-and-practice; but a programming language can also *describe* this process clearly.

```
     ∇ DRILL
[1]    NEWPROBLEM:
[2]    'MULTIPLY'
[3]    □←FIRST←?20
[4]    □←SECOND←?20
[5]    ENTER:ANSWER←□
[6]    →NEWPROBLEM IF
       ANSWER=FIRST×SECOND
[7]    'NOPE. TRY AGAIN.'
[8]    →ENTER
     ∇
```

The DRILL program begins with a NEWPROBLEM and prints 'MULTIPLY', a simplified message telling the student what to do with the two numbers that will follow. The FIRST number is an integer randomly chosen between 1 and 20, and the SECOND number likewise.

The student may ENTER his ANSWER, which is then evaluated by the program. IF the ANSWER equals the FIRST number times the SECOND number, a NEWPROBLEM is given; otherwise (if ANSWER is wrong) 'NOPE. TRY AGAIN.' is printed, and the student may ENTER his answer again.

Note: IF is a sub-program used to facilitate the reading of branching commands. Its definition is:

```
∇ BRANCH←LINE IF CONDITION
[1]    BRANCH←CONDITION/LINE
```

Its syntax is: →(line number) IF (condition)

IF the condition is true (evaluates to 1), the program branches to the line number (or line label) given; IF the condition is false (evaluates to 0), the program branches to the next line.

To use the DRILL program, type in its name. The following is a sample:

```
      DRILL
MULTIPLY
 19
 2
□:
      38
MULTIPLY
 16
 18
□:
      248
NOPE. TRY AGAIN.
□:
      288
MULTIPLY
 8
 12
□:
      96
MULTIPLY
 6
 2
□:
      12
MULTIPLY
 14
 18
□:
```

Students notice immediately that this program has a flaw — it doesn't stop! Scrutinizing the program's definition reveals that after getting a multiplication problem correct, one always gets a new problem, ad infinitum. Also, after getting a problem wrong, the student must answer that same problem again — another potentially endless loop. The student's first task, then, might be to build in an option to stop the program at will.

DRILL is, of course, only a prototype program. With other modifications of one's choosing, DRILL may become considerably more sophisticated. Possible extensions include: (a) displaying pictorial feedback — like a "smiley face" for positive reinforcement or a "grouchy face" instead of 'NOPE. TRY AGAIN.'; (b) presenting a pre-specified total number of problems; (c) limiting the number of allowable mistakes on individual problems (or all problems); (d) generalizing the multiplicands to create a more flexible range of problems (including negative numbers, decimals, etc.); (e) gathering performance data; (f) using performance criteria to make diagnoses; (g) automatically adapting level of difficulty based on diagnoses; (h) adding personalized instructions; and (i) building in timing components, jump-ahead options and hints.

Psychology

Computer programs suitable for viewing can help students learn some fundamentals of psychology. In studying behavior, for example, consider the following APL program which models — albeit crudely — an emotional reaction. TEMPER is a program which will, under certain conditions, "get mad at you". (This program is similar to one written in a simplified Fortran by John Loehlin in *Computer Models of Personality*, Random House, NY 1968.)

```
     ∇ TEMPER
[1]    EMOTION←0
[2]    NEW:EMOTION←□
       +EMOTION+2
[3]    →MAD IF EMOTION>10
[4]    →NEW
[5]    MAD:'**!?!**?!!'
     ∇
```

The program begins with zero EMOTION and then encounters a series of numbers, representing "events" in the life of the program. A low number is low in emotional significance, whereas high numbers are highly emotion-producing.

Each time a number is entered, the program generates a NEW EMOTION based on a simple mathematical model: EMOTION becomes the number just entered plus one half of the previous EMOTION. (In the course of human events, this might be akin to the ameliorating effect of time on emotional burdens — "sleeping on your troubles".)

This process continues until a test condition — the "threshold" for mad behavior — is exceeded. The program goes MAD if EMOTION ever becomes greater than 10 (**!?!**?!! is the computer's programmed vernacular.)

To use the program, the child types TEMPER and enters a sequence of numbers. For example;

```
      TEMPER
0:
      4
0:
      6
0:
      8
**!?!**?!!
```

Here, a 4 is like "stubbing your toe", 6 is like "losing your wallet", and 8 is like "missing the last bus". This sequence produced MAD behavior. But, suppose you enter the same numbers in a different order:

```
      TEMPER
0:
      8
0:
      6
0:
      4
0:
      →
```

Here, the program does not display MAD: '**!?!**?!!'. Apparently, (for this model) the sequence 8 6 4 is "tolerable", whereas the previous sequence 4 6 8 clearly was not to tolerable!

Again this model suggests an analogy with human behavior. Experiencing the most emotion-packed events first and then tapering off may be more tolerable than the reverse.

Other variations of input also suggest interpretation in terms of human psychology. Sandwiching a low-emotion event between two high-emotion events, say 7 2 7, can make the total sequence tolerable; by contrast, the events 7 7 2 and 2 7 7 produce mad behavior.

The mathematics underlying this TEMPER model can be exposed quickly and naturally. For example, after some experimentation with the program, you might wonder: How many 5s can the program take before it "blows its top"?

```
      TEMPER
0:
      5
0:
      5
0:
      5
0:
      5
0:
      5
0:
      5
0:
```

A sequence of 5s builds up EMOTION to higher and higher values, but never reaches 10. This process parallels the well-known geometric series 1, 1/2, 1/4, 1/8, 1/16, 1/32, . . . , the sum of which converges to 2. Exploring in this way, a child may gain some insight into the nature of infinite series in an active and interesting (at least less abstract) setting.

Some simple modifications of the TEMPER program students might make are to: (a) change the threshold, for example, from 10 to 25 for higher tolerance or to ?25 (a random number) for unpredictable behavior; (b) modify the model, for example, from EMOTION ÷ 2 to EMOTION ÷ 3 to express stronger "forgetting"; (c) adapt the program for use by others by inserting conversational statements such as "ENTER NUMBERS FROM 1 to 9" or even "CAUTION! THIS PROGRAM MAY BECOME EMOTIONAL . . .", and (d) make the program dynamic by automatically resetting EMOTION to 0 after an emotional catharthis.

Possible extensions of TEMPER include: (a) writing related programs, such as a version with multiple emotional dimensions like ANGER, FEAR and LOVE; and (b) writing companion programs, such as two TEMPER-like programs which interact with each other so that one's output is the other's input.

These are but two "glass box" programs which may be used for teaching with APL. Each program illustrated can be extended further, and similar progams may be written for other topics. For more examples, see my book *Instructional Applications of Computers Using APL*, Addison-Wesley, Menlo Park, California.

Such "glass box" programs are well-suited for personal computing, as they require only a few minutes to enter and have minimal storage requirements. Micro-APL systems now available include the IBM 5100 (with full APL BASIC); IBM 5110 (with increased capabilities and more expense); Vanguard's Z80 (with nearly complete APL facilities); EMPL (a subset of APL designed for 8080 machines); Microsoft's APL (now in development); and (expected next year) APL with virtual memory and time-sharing on Z-8000 and 8086 16-bit microcomputers. □

For Further Reading

Papert, S. "Teaching Children Thinking", M.I.T. LOGO Memo #2, Oct. 1971.

Iverson, K.E. "APL in Exposition", IBM Tech. Report #320-3010, Jan. 1972.

Berry, P. et.al. "APL and Insight: The Use of Programs to Represent Concepts in Teaching", IBM Tech. Report #320-3020, March 1973.

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CIRCLE 14

Word Processing

A Novel Program

BY CHARLEY WINTERBAUER

With this word processing program, you can produce flawless text easily — whether you're writing a short note, program documentation, magazine article or even a complete novel. Simply type in your text at the keyboard, just as you would use a typewriter. The Novel program then lets you make changes and corrections to the text appearing on the CRT. You can save the text and later retrieve it for more editing; and, finally, you can produce perfect copies on your printer.

Hardware

Much of the program depends on the hardware configuration. This configuration will be discussed first. My hardware is just a combination of common, commercially available home computer components.

Major components comprising my system are:

CPU — MITS Altair 8800b

Memory — 48 K static (various brands)

Cassette Interface — Dajen with read & write

Cassettes — Sears 799 21682 501, Sony TC-67

Keyboard — Southwest Technical Products

Video Monitor — Converted TV set

Video Interface — Miniterm Assoc. Merlin

Printer — IBM Selectric with Escon conversion

Printer Interface — Home design

The cassette interface allows one cassette to serve as a read unit and one as a write unit — a feature necessary for the edit portion of the program. The cassettes, garden variety recorders operating at a 2500 baud, used medium priced tapes.

The power of the program relies on using routines provided in the software furnished with Miniterm's Merlin. In addition to the video signal to drive the TV, Merlin provides many software editing features resident in read only memory (ROM). And, besides the functions a programmer would want (dump memory, modify memory, examine CPU registers, and so forth), Merlin has a text editor.

The Novel program calls on all of the edit functions. The more useful functions include:

Edit-S — Move cursor down one line

Edit-G — Move cursor up one line

Edit-D — Move cursor back one space

Edit-F — Move cursor forward one space

Edit-W — Delete one character. The Miniterm routine automatically shifts the characters that follow.

Edit-E — Delete line

Edit-X — Enter insertion mode, letting you insert any number of characters into the middle of already written text. The Miniterm routine automatic-

Table 1

256×8 PROM for ASCII to Selectric Conversion

CHAR	ADDRESS Hex	CONTENTS Hex
NUL	00	00
SOH	01	00
STX	02	00
ETX	03	00
EOT	04	00
ENQ	05	00
ACK	06	00
BEL	07	02
BS	08	04
HT	09	08
LF	0A	00
VT	0B	10
FF	0C	00
CR	0D	20
SO	0E	00
SI	0F	00
DLF	10	00
DC1	11	00
DC2	12	00
DC3	13	00
DC4	14	00
NAK	15	00
SYN	16	00
ETB	17	00
CAN	18	00
EM	19	00
SUB	1A	00
ESC	1B	00
FS	1C	00
GS	1D	00
RS	1E	00
US	1F	00
SP	20	40
!	21	97
"	22	D5
#	23	FE
$	24	F9
%	25	F5
&	26	FD
'	27	95
(	28	F0
)	29	F1
*	2A	FC
+	2B	C6
,	2C	8C
-	2D	80
.	2E	96
/	2F	89

CHAR	ADDRESS Hex	CONTENTS Hex
0	30	B1
1	31	A9
2	32	B6
3	33	BE
4	34	B9
5	35	B5
6	36	B4
7	37	BD
8	38	BC
9	39	B0
:	3A	CD
;	3B	8D
<	3C	97
=	3D	86
>	3E	D7
?	3F	C9
@	40	F6
A	41	DC
B	42	E0
C	43	EC
D	44	ED
E	45	E5
F	46	CE
G	47	CF
H	48	E1
I	49	D4
J	4A	C7
K	4B	E4
L	4C	E9
M	4D	DF
N	4E	E6
O	4F	D9
P	50	C5
Q	51	C4
R	52	DD
S	53	D1
T	54	E7
U	55	EE
V	56	DE
W	57	D0
X	58	EF
Y	59	C1
Z	5A	F7
[	5B	FF
¢	5C	F4
]	5D	BF
EA↑	5E	E5
_	5F	C0

CHAR	ADDRESS Hex	CONTENTS Hex
	60	95
a	61	9C
b	62	A0
c	63	AC
d	64	AD
e	65	A5
f	66	8E
g	67	8F
h	68	A1
i	69	94
j	6A	87
k	6B	A4
l	6C	A9
m	6D	9F
n	6E	A6
o	6F	99
p	70	85
q	71	84
r	72	9D
s	73	91
t	74	A7
u	75	AE
v	76	9E
w	77	90
x	78	AF
y	79	81
z	7A	B7
{	7B	FF
¦	7C	CD
}	7D	BF
~	7E	00
DEL	7F	00
	80	00
	81	00
	82	00
	83	00
	84	00
	85	00
	86	00
	87	00
	88	00
	89	00
	8A	00
	8B	00
	8C	00
	8D	00
	8E	00
	8F	00

		SP	CR	Indx	HT	BS	BEL	SPare	- Machine Command
Selectric Codes	bit#	SP 7	SH 6	T2 5	T1 4	R5 3	R2A 2	R2 1	R1 0 - Ball Command

Bit 7 is Character Print

ally shifts characters to accommodate the new addition.

Edit-C — Exit insertion mode

It may sound as though the Miniterm device had done it all. Not so. For instance, the Miniterm does not have a lower case scan converter. All characters are upper case. In any article or book, upper and lower case are necessary, but you don't want to print it out to see which case it was. Somehow I had to display both upper and lower on the CRT.

Miniterm does have the capability to reverse the display of the character. That is, if you have the background dark with the letters light, then any individual letter may be reversed. You guessed it: The program uses this feature; upper case characters become black lettering surrounded by a small square of white.

Since I already had a Selectric, I naturally decided to convert it to a printer using the ESCON conversion kit. I only purchased the solenoids since I'd already designed the interface. The basic concept for the Selectric code conversion interface circuitry came from Don Lancaster's *TV Typewriter Cookbook*. I modified his design by including several one-shots for the character print. Capital letters need a longer delay to allow the Selectric ball to rotate the additional 180 degrees. For programming the ROM see Table 1.

Physically, the ROM and associated circuitry are located on an S-100 bus, wire-wrapped breadboard card inside the CPU mainframe. The solenoid drivers are located 20 feet away in a small box mounted under the typewriter table. A short cable connects these drivers to the solenoids mounted in the guts of the typewriter. With the delays required for reliable typing programmed in, the computer drives the Selectric at about 10 cps.

Software Organization

The Novel program is divided into three modes:

1. *Input mode*. The author sits at the video keyboard and types onto the screen. Errors can be corrected using the proper edit keys.

The records stored on the cassette represent paragraphs. This format (a) overcomes the problem of the CRT and the typewriter not having the same horizontal character spacing which makes line accounting difficult; and (b) speeds up the reading of the tape since fewer records are on a page.

2. *Edit mode*. Here, both tape units are used. The previously stored data, recalled a paragraph at a time, is edited as appropriate. In addition to recalling each paragraph starting at one, you can recall a paragraph from anywhere. All of the preceding paragraphs are rewritten on the new tape first, but do not appear on the CRT.

You can add a new paragraph after any existing one without fouling up the paragraph numbering system. The program renumbers the paragraphs as it puts them on the new tape, allowing you to add as many paragraphs as you want without losing count in the final tape. You also have the option of deleting any paragraph requested. At the end of each edited paragraph, you can also delete the paragraph, end the chapter immediately, finish the rest of the chapter by copying the remaining paragraphs verbatim, or request another subsequent paragraph to be displayed and edited.

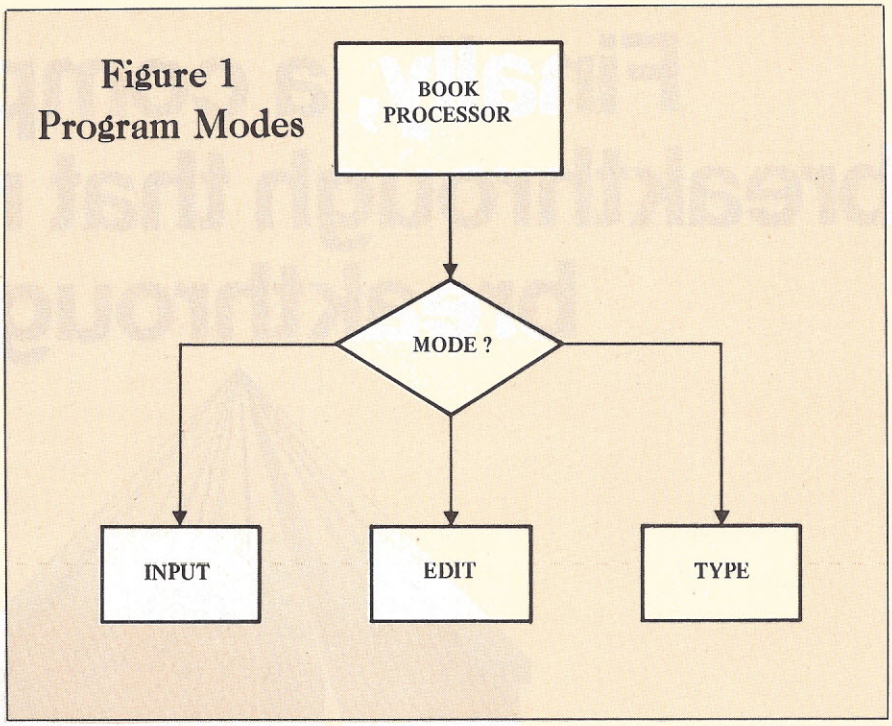
Chapter numbers as well as paragraph numbers are recorded as part of the record. Thus, you can put several chapters on one cassette and still sort them out. In practice, however, it becomes quite time consuming to record more than one chapter per cassette side.

3. *Typing mode*. This mode, which may seem the simplest, is the most sophisticated. During the input mode, I type with wild abandon, not caring where the line ends on the CRT, not caring where the Miniterm software puts the carriage return and not caring about the ultimate format of the typewritten page. Thus, the Novel program's type mode has to keep track of the words going out to the typewriter on a line basis. The forty characters per CRT line do not map exactly to the typewritten page. The program determines when to insert carriage returns and eliminates double spaces after periods when these typewriter carriage returns are inserted. (A carriage return in the middle of a word is verboten, of course.) The program keeps track of the number of lines on a page so it can insert the proper number of carriage returns to skip past the perforation separating one printout sheet from another. Finally, the program looks at each letter to decide upper case or lower case, then determines the appropriate delay before the next character.

The keyboard has a two-position switch: (1) upper and (2) upper plus lower. The upper mode is used with the system monitor, which only understands upper case. In the upper plus lower mode, the shift key determines the state just as it does on a typewriter. In the program then, the ASCII code from the keyboard denotes either upper case or lower case, depending on the shift key position.

The input and edit modes of the program make conversions for the display. Both the input mode and edit mode converse in this converted ASCII code to provide the reversed display for capital letters. The tapes are made in this code. Thus, the type mode program must convert back to ASCII so the interface circuitry can convert to the Selectric code. I could have programmed the ROM with the modified ASCII, but it seemed better to output from the type mode program in ASCII.

Figure 1
Program Modes



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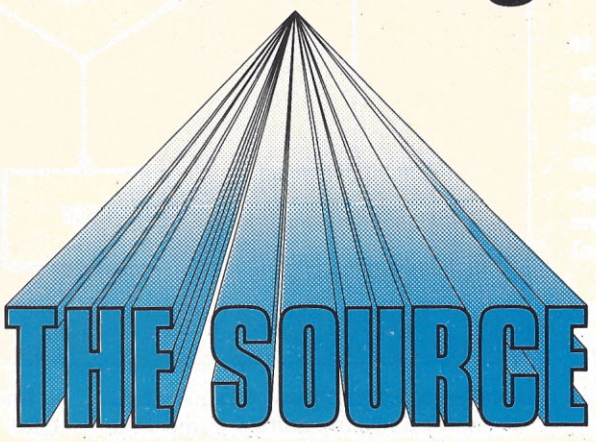

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CIRCLE 15

The type mode also must accept the start of the first line in other than a fixed, predetermined place. In practice, I don't retype a whole chapter when I make a small change in the middle. Since perhaps only one or two pages end up being affected, the type mode must be capable of reading the tape and starting the typing at a designated paragraph and line number.

Operating Illustrations

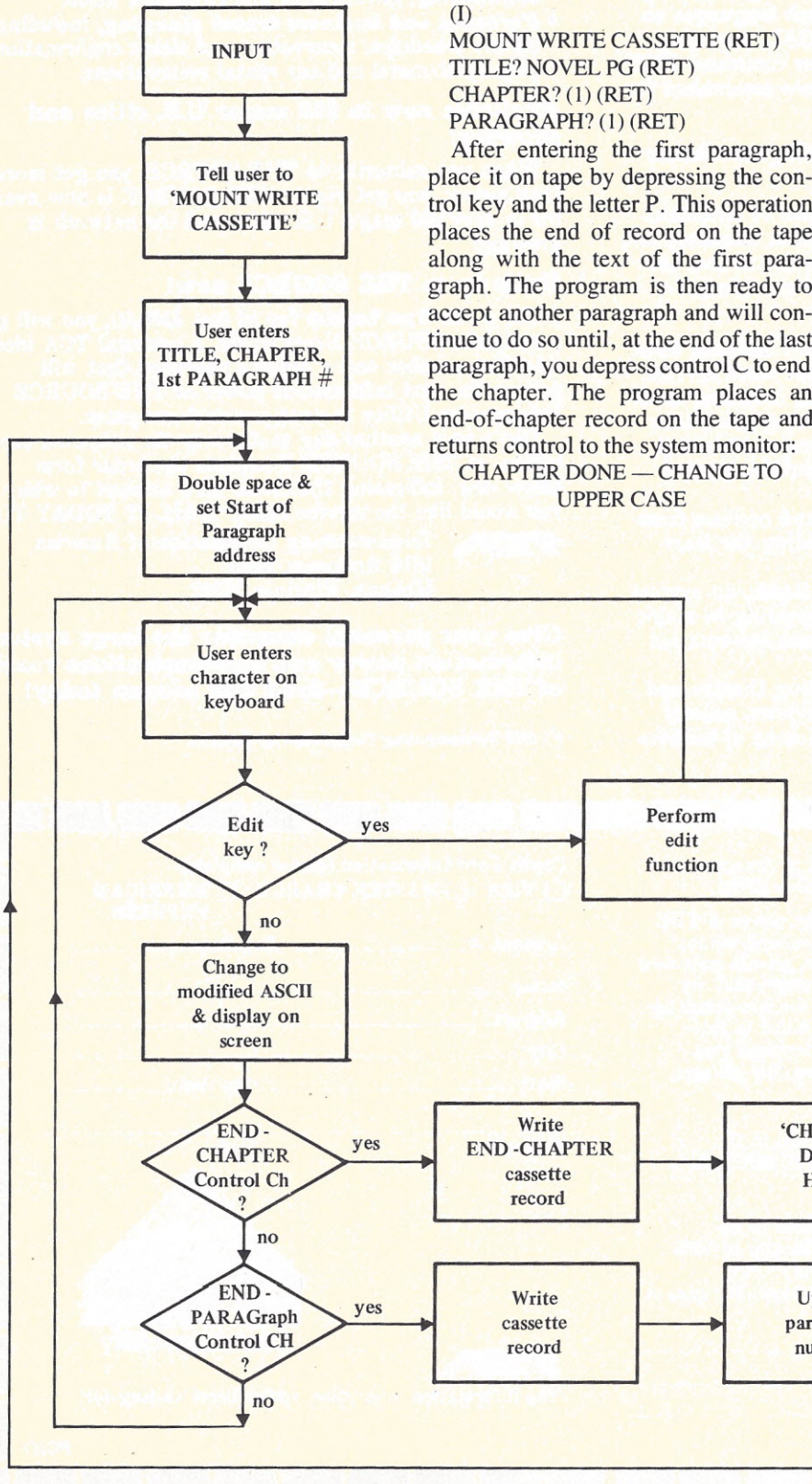
The input mode gives operator instructions and responses required, illustrated in the sample CRT display below. Parentheses denote operator responses.

The program is executed first:

E5200
BOOK PROCESSOR: CHANGE KEYBOARD TO UPPER PLUS LOWER
INPUT, EDIT OR TYPE?
(I)
MOUNT WRITE CASSETTE (RET)
TITLE? NOVEL PG (RET)
CHAPTER? (1) (RET)
PARAGRAPH? (1) (RET)

After entering the first paragraph, place it on tape by depressing the control key and the letter P. This operation places the end of record on the tape along with the text of the first paragraph. The program is then ready to accept another paragraph and will continue to do so until, at the end of the last paragraph, you depress control C to end the chapter. The program places an end-of-chapter record on the tape and returns control to the system monitor:

CHAPTER DONE — CHANGE TO UPPER CASE



At this point you can re-execute and input more text, or edit or type the tape just made. I'll illustrate the edit mode next:

E5200
BOOK PROCESSOR: CHANGE KEYBOARD TO UPPER PLUS LOWER
INPUT, EDIT OR TYPE?
(E)
MOUNT READ AND WRITE CASSETTE (RET)
TITLE? NOVEL PG (RET)
CHAPTER? (1) (RET)
PARAGRAPH? (1) (RET)
ENTER PARAGRAPH # TO EDIT,
OR CNTL-F TO FINISH CHAPTER,
OR CNTL-C TO END CHAPTER IMMEDIATELY (1)
PARAGRAPH 1

When the called paragraph is displayed, you can edit as discussed previously. Control P again puts the paragraph out on tape. Next, the program responds with the following message:

WANT TO ENTER A NEW PARAGRAPH? Y OR N

If Y then the cursor advances and waits for the next paragraph entry. If N then the next message appears:

ENTER PARAGRAPH # TO EDIT,
OR CNTL-F TO FINISH CHAPTER,
OR CNTL-C TO END CHAPTER IMMEDIATELY (2) (or whatever)

This process continues on until completion or until you end the chapter with control C or control F. Then the program returns to the system monitor:

CHAPTER DONE — CHANGE TO UPPER CASE

As illustrated, the paragraph number appears on the screen, along with the contents of the paragraph, to help keep track of where you are. If, in spite of this, you lose track or hit the wrong key for the requested paragraph, then one of the following will happen: (a) If the paragraph number is beyond the maximum paragraph number on tape, then

Figure 2 Input Mode

the program completes the chapter translation onto the new tape. (b) If the paragraph number exists on the tape ahead, then that paragraph will be displayed on the screen. (c) If the number of an already passed paragraph is pressed, then the next available paragraph is recalled along with an added message that it was a "BAD PARAGRAPH ENTRY". The recalled paragraph is numbered so you can get back on track.

I use this feature deliberately by entering a 1 when I'm well into the chapter and have lost count. The next paragraph comes up with the message and then I know where I am.

Paragraph numbers are only displayed on the screen; they are blanked from appearing on the typed output. (The program could be modified to include the numbers on rough copies to aid in editing the text.)

The type mode begins like the others. After selecting the type mode, you get this message:

MOUNT READ CASSETTE (RET)
TITLE? NOVEL PG (RET)
START TYPE PARAGRAPH (1) (or whatever) (RET)
TYPEWRITER LINE NUMBER; (1 through 29) (The program is set up for double spacing.)

The complete chapter is typed out with no indication on the screen until the program completes the chapter.

I use Moore business form paper 9510-LA, perforated, 8-1/2 by 11, 2500 sheets per box. Careful paper alignment allows a dozen or more pages to be typed without realignment. If realignment is necessary, you can stop and restart the computer without any effect on the output copy. If it is necessary, I usually realign the paper between pages so the slight margin shift doesn't show.

When finished typing, the program gives the word count of that chapter and returns control to the system monitor.

This complete article, except for the flowcharts and table, was written on the system. The listing was printed with a special routine which only outputs lower case, speeding up the output. I used a typewriter ball with all upper case characters. The symbol # looks like a backwards "h" with that ball.

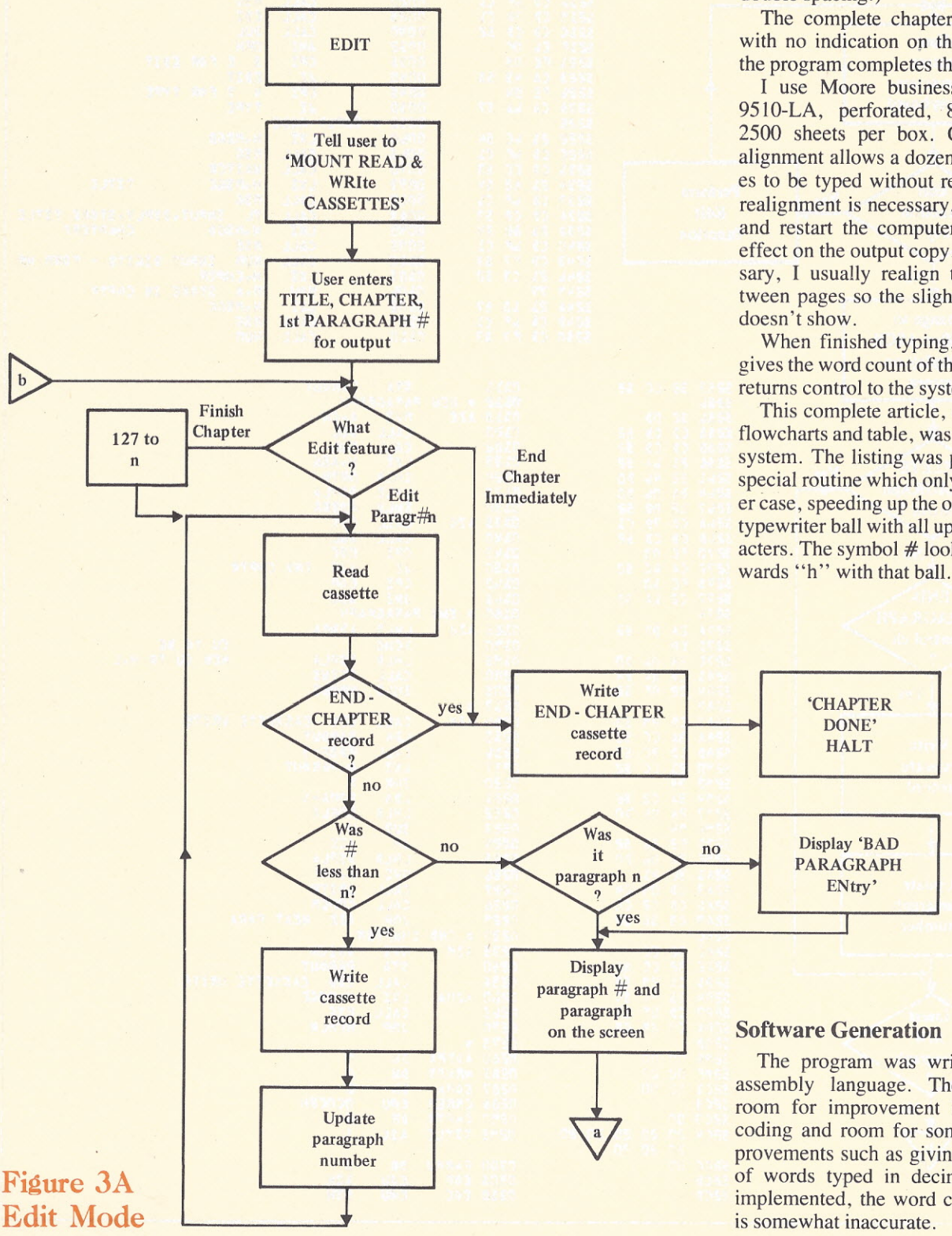


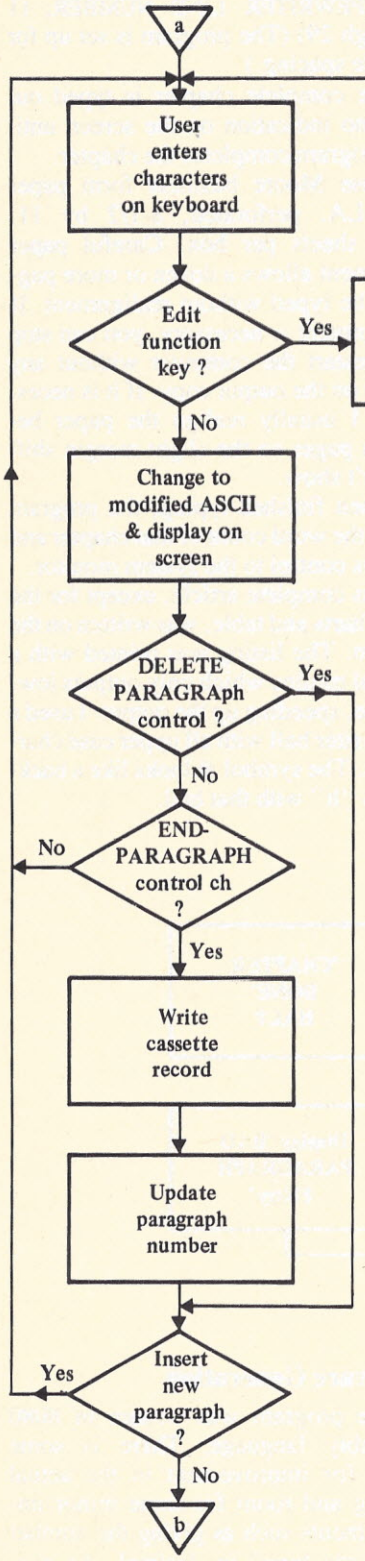
Figure 3A
Edit Mode

Software Generation

The program was written in 8080 assembly language. There is some room for improvement in the actual coding and room for some minor improvements such as giving the number of words typed in decimal. As now implemented, the word count, in hex, is somewhat inaccurate. □

Program Listing

Figure 3B
Edit Mode

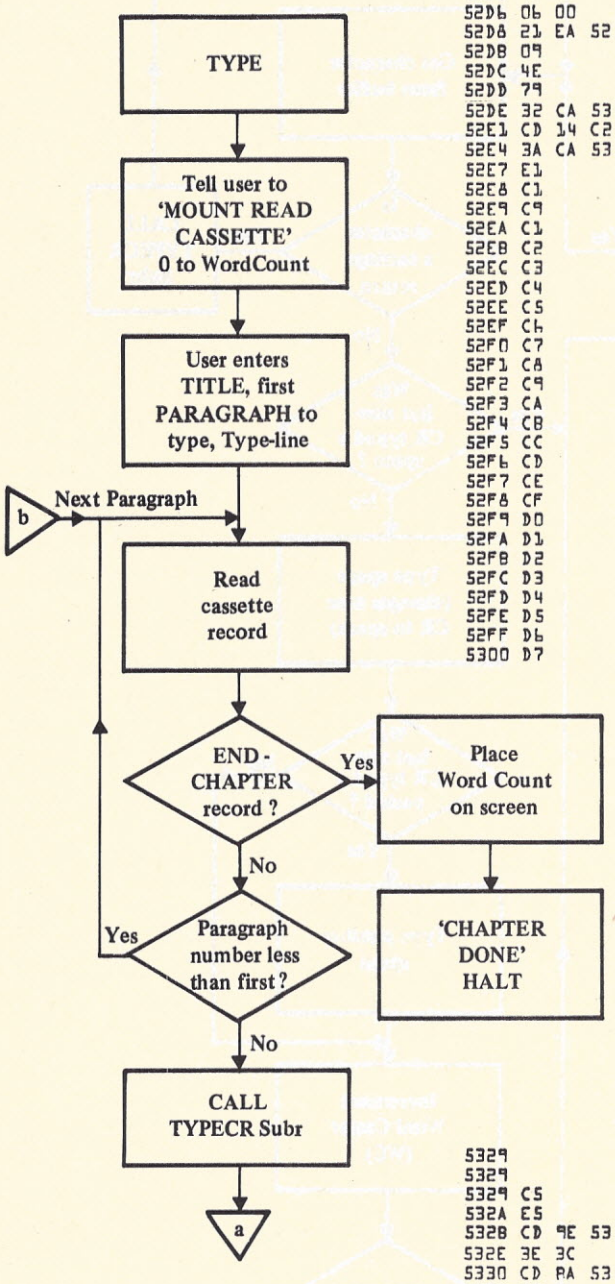



```
A 5200

5200 21 3B 54      0005 AZA    LXI   H,MSGA          BOOK PROC
5203 CD BF C1      0007        CALL  MSG
5206 21 00 10      0010        LXI   H,1000H
5209 EB            0011        XCHG
520A 2A 0C 00      0013        LHLD  EOM
520D CD D4 54      0014        CALL  GETNS
5210 22 C1 52      0015        SHLD  EOMA
5213               0017 *
5213 21 8C 54      0019        LXI   H,MSGF          MODE
5216 CD BF C1      0020        CALL  MSG
5219 CD 78 C1      0025        CALL  CDI
521C CD CD 52      0030        CALL  DUL
521F E6 0F         0032        ANI   0FH
5221 FE 05         0035        CPI   5  E FOR EDIT
5223 CA 43 55      0040        JZ    EDIT
5226 FE 04         0045        CPI   4  T FOR TYPE
5228 CA 6A 57      0050        JZ    TYPE
522B               0055 * INPUT MODE
522B 21 6C 54      0060        LXI   H,MSGB
522E CD BF C1      0065        CALL  MSG
5231 CD EE 53      0070        CALL  WAITCR
5234 21 82 54      0075        LXI   H,MSGC          TITLE
5237 CD BF C1      0080        CALL  MSG
523A CD CB 53      0085        CALL  TL  INPUT,DSPLY,STORE TITLE
523D 21 8B 54      0090        LXI   H,MSGD          CHAPTER?
5240 CD BF C1      0095        CALL  MSG
5243 CD F7 53      0100        CALL  NUM  INPUT DIGITS - FORM NR
5246 21 C3 52      0105        LXI   H,CHPTR
5249 77            0106        MOV   M,A  STORE IN CHPTR
524A 21 15 57      0108        LXI   H,MSGK
524D CD BF C1      0109        CALL  MSG
5250 CD F7 53      0110        CALL  NUM

5253 32 CC 52      0111        STA   PAROUT
5256               0112 * NEW PARAGRAPH
5256 3E 0D         0115 AZE    MVI   A,CR
5258 CD CD 52      0120        CALL  DUL
525B CD CD 52      0122        CALL  DUL
525E 21 6A 52      0123        LXI   H,AZG
5261 22 46 00      0124        SHLD  MRTN
5264 2A 06 00      0125        LHLD  DSPLA
5267 22 BD 52      0130        SHLD  ADDRA
526A CD 78 C1      0135 AZG    CALL  CDI
526D CD CD 52      0140        CALL  DUL
5270 FE 03         0145        CPI   EOC
5272 CA AC 52      0150        JZ    AZM  END CHPTR
5275 FE 10         0160        CPI   EOP
5277 C2 6A 52      0165        JNZ   AZG
527A               0180 * END PARAGRAPH
527A 2A BD 52      0185 AZJ    LHLD  ADDRA
527D EB            0190        XCHG                  CU TO DE
527E 2A 06 00      0195        LHLD  DSPLA           NEW CU TO H,L
5281 CD D4 54      0200        CALL  GETNS
5284 22 BF 52      0205        SHLD  NRWDS
5287               0213 *
5287 CD 29 53      0214 AZK    CALL  CSW  CASSETTE WRITE
528A 3A CC 52      0215        LDA   PAROUT
528D CD 3C 57      0216        CALL  PDSP+3
5290 21 CC 52      0217        LXI   H,PAROUT
5293 34            0220        INR   M
5294 3A C2 52      0221        LDA   EOMA+1
5297 2A 06 00      0222        LHLD  DSPLA
529A 94            0223        SUB   H
529B F2 56 52      0224        JP    AZE
529E 2A 06 00      0225        LHLD  DSPLA
52A1 3E 41         0226        MVI   A,'A'
52A3 CD 09 C4      0227        CALL  EDITM
52A6 CD C2 C0      0228        CALL  CRMEM
52A9 C3 56 52      0229        JMP   AZE  NEXT PARA
52AC               0230 * END CHAPTER
52AC 3E EC         0235 AZM    MVI   A,ECH
52AE 32 CC 52      0250        STA   PAROUT
52B1 CD 29 53      0255        CALL  CSW  CASSETTE WRITE
52B4 21 96 54      0260 AZMA   LXI   H,MSGE
52B7 CD BF C1      0265        CALL  MSG
52BA C3 28 C0      0270        JMP   MERLN
52BD               0275 *
52BD 00 00         0280 ADDRA  DW    0
52BF 00 00         0285 NRWDS  DW    0
52C1 00 00         0287 EOMA   DW    0
52C3               0288 CRMEM  EQU   0C0C2H
52C3 00            0290 CHPTR  DB    0
52C4 20 20 20 20 20 0295 TITLE ASC   '
     20 20 20
52CC 00            0300 PAROU  DB    0
52CD               0305 EOP    EQU   10H
52CD -             0310 EOC    EQU   03H
```

Figure 4A
Type Mode

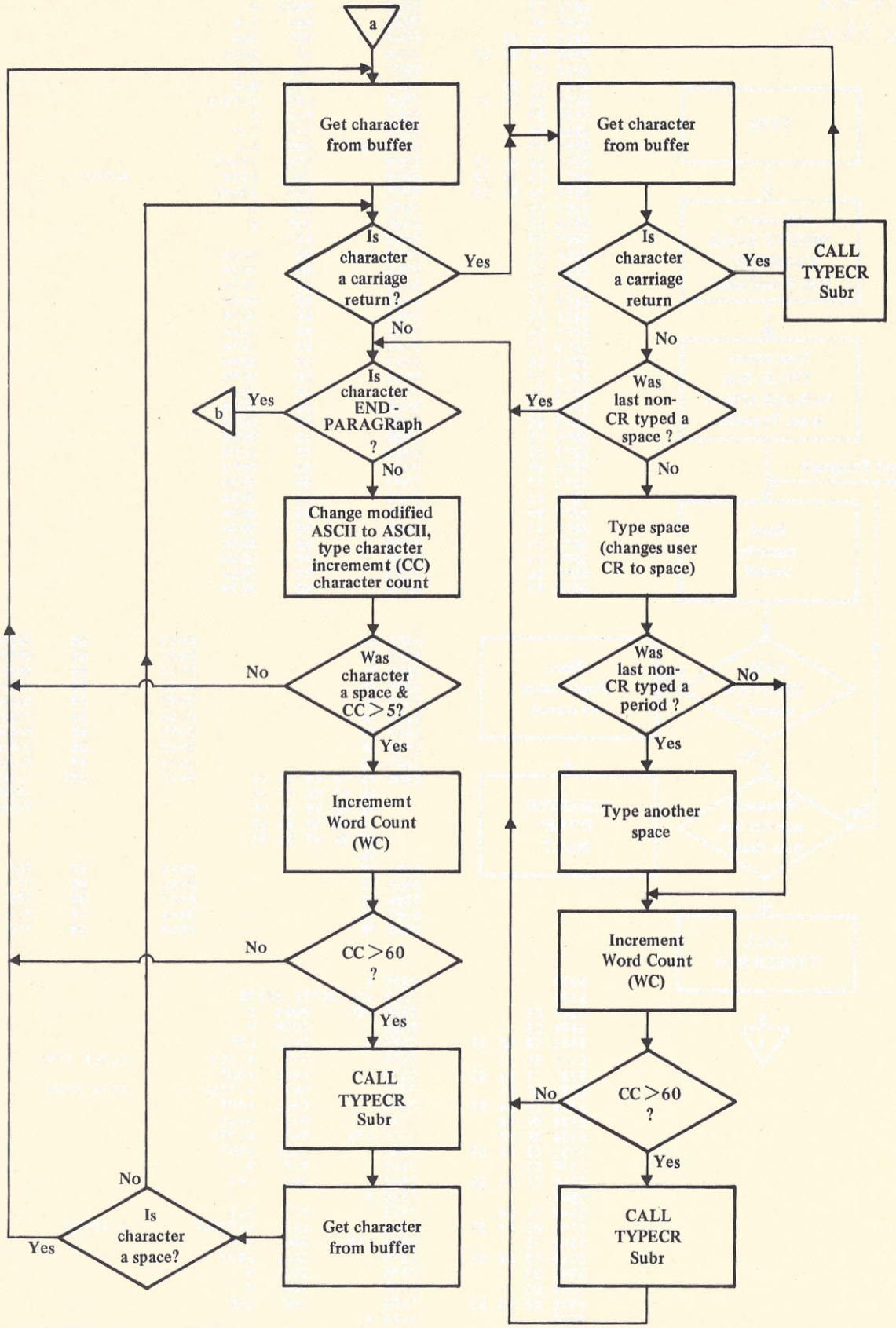



```
52CD                    0311 FC     EQU   6  FINISH CHPTR
52CD                    0312 DP     EQU   4  DELETE PARA
52CD                    0313 ECH    EQU   0ECH          END CHPTR ON CASSETTE
52CD                    0314 CR     EQU   0DH
52CD                    0320 * DISPLAY UPPER AND LOWER
52CD C5                 0325 DUL    PUSH  B
52CE E5                 0330        PUSH  H
52CF 4F                 0335        MOV   C,A
52D0 DE 41              0340        SBI   41H
52D2 FA DD 52           0345        JM    DULA
52D5 4F                 0350        MOV   C,A
52D6 06 00              0355        MVI   B,0
52D8 21 EA 52           0360        LXI   H,TDUL
52DB 09                 0365        DAD   B
52DC 4E                 0370        MOV   C,M
52DD 79                 0375 DULA   MOV   A,C
52DE 32 CA 53           0380        STA   ASAVE
52E1 CD 14 C2           0385        CALL  DISO          OUTPUT C
52E4 3A CA 53           0390        LDA   ASAVE
52E7 E1                 0395        POP   H
52E8 C1                 0400        POP   B
52E9 C9                 0405        RET
52EA C1                 0410 TDUL   DB    0C1H
52EB C2                 0411        DB    0C2H
52EC C3                 0412        DB    0C3H.
52ED C4                 0413        DB    0C4H
52EE C5                 0414        DB    0C5H
52EF C6                 0415        DB    0C6H
52F0 C7                 0416        DB    0C7H
52F1 C8                 0417        DB    0C8H
52F2 C9                 0418        DB    0C9H
52F3 CA                 0419        DB    0CAH
52F4 CB                 0420        DB    0CBH
52F5 CC                 0421        DB    0CCH
52F6 CD                 0422        DB    0CDH
52F7 CE                 0423        DB    0CEH
52F8 CF                 0424        DB    0CFH
52F9 D0                 0425        DB    0D0H
52FA D1                 0426        DB    0D1H
52FB D2                 0427        DB    0D2H
52FC D3                 0428        DB    0D3H
52FD D4                 0429        DB    0D4H
52FE D5                 0430        DB    0D5H
52FF D6                 0431        DB    0D6H
5300 D7                 0432        DB    0D7H

5301 D8                 0433        DB    0D8H
5302 D9                 0434        DB    0D9H
5303 DA                 0435        DB    0DAH
5304 5B                 0436        DB    05BH
5305 5C                 0437        DB    05CH
5306 5D                 0438        DB    05DH
5307 5E                 0439        DB    05EH
5308 5F                 0440        DB    05FH
5309 60                 0441        DB    060H
530A 41 42 43 44 45     0442        ASC   'ABCDEFGHI
     46 47 48 49 4A                       JKLMNOPQRS
     4B 4C 4D 4E 4F                       TUVWXYZ'
     50 51 52 53 54
     55 56 57 58 59
     5A
5324 7B                 0445        DB    7BH
5325 7C                 0446        DB    7CH
5326 7D                 0447        DB    7DH
5327 7E                 0448        DB    7EH
5328 7F                 0449        DB    7FH

5329                    0500 *
5329                    0505 *CASSETTE WRITE
5329 C5                 0510 CSW    PUSH  B
532A E5                 0515        PUSH  H
532B CD 9E 53           0520        CALL  LDR
532E 3E 3C              0525        MVI   A,3CH         CLOCK SYNC
5330 CD BA 53           0530        CALL  AOUT
5333 3E E6              0535        MVI   A,0E6H        DATA SYNC
5335 CD BA 53           0540        CALL  AOUT
5338 06 0A              0545        MVI   B,10
533A 3E 7F              0550 LPA    MVI   A,7FH
533C CD BA 53           0555        CALL  AOUT
533F 05                 0560        DCR   B
5340 C2 3A 53           0565        JNZ   LPA
5343                    0570 *
5343 06 08              0575        MVI   B,8
5345 21 C4 52           0580        LXI   H,TITLE       8 ASCII
5348 7E                 0585 LPB    MOV   A,M
5349 CD BA 53           0590        CALL  AOUT
534C 23                 0595        INX   H
534D 05                 0600        DCR   B
534E C2 48 53           0605        JNZ   LPB
5351                    0610 *
5351 21 C3 52           0615        LXI   H,CHPTR       CHAPTER NR 0-255
5354 7E                 0620        MOV   A,M
```

Figure 4B
Type Mode



```
5355 CD PA 53       0625          CALL   AOUT
5358                0630 *
5358                0650 *
5358 21 CC 52       0655          LXI    H,PAROUT       NR 0-255
535B 7E             0660          MOV    A,M
535C CD PA 53       0665          CALL   AOUT
535F FE EC          0667          CPI    ECH
5361 CA 94 53       0669          JZ     LPD
5364 3A BF 52       0670          LDA    NRWDS
5367 4F             0675          MOV    C,A
5368 3A CO 52       0680          LDA    NRWDS+1
536B 47             0685          MOV    B,A
536C 2A BD 52       0690          LHLD   ADDRA
536F 7E             0695 LPC      MOV    A,M
5370 CD PA 53       0700          CALL   AOUT
5373 23             0702          INX    H
5374 EB             0703          XCHG
5375 2A OC DO       0704          LHLD   EOM
5378 7C             0705          MOV    A,H
5379 BA             0706          CMP    D
537A C2 88 53       0707          JNZ    LPCA
537D 7D             0708          MOV    A,L
537E BB             0709          CMP    E
537F C2 88 53       0710          JNZ    LPCA
5382 2A 08 DO       0711          LHLD   HOME
5385 C3 89 53       0712          JMP    LPCB
5388 EB             0713 LPCA     XCHG
5389 0B             0720 LPCB     DCX    B
538A 3E 00          0725          MVI    A,0
538C B8             0730          CMP    B
538D C2 6F 53       0735          JNZ    LPC
5390 B9             0740          CMP    C
5391 C2 6F 53       0745          JNZ    LPC
5394 CD 9E 53       0750 LPD      CALL   LDR
5397 3E 30          0755          MVI    A,30H          TURN OFF
5399 D3 5E          0760          OUT    CASCO          5E
539B E1             0765          POP    H
539C C1             0770          POP    B
539D C9             0775          RET
539E                0780 *
539E 3E 00          0785 LDR      MVI    A,0  LEADER
53A0 D3 5C          0790          OUT    CASFC          FILL CHAR  5C
53A2 3E 14          0795          MVI    A,14H          TURN ON RELAY,SET XMIT
53A4 D3 5E          0800          OUT    CASCO          5E
53A6 CD AA 53       0805          CALL   DLY
53A9 C9             0810          RET
53AA                0815 *
53AA 0E 03          0820 DLY      MVI    C,3  COUNT 0-7F00 3 TIMES
53AC 21 00 00       0825 DLYA     LXI    H,0
53AF 23             0830 DLYB     INX    H
53B0 7C             0835          MOV    A,H
53B1 3C             0840          INR    A
53B2 F2 AF 53       0845          JP     DLYB
53B5 0D             0850          DCR    C
53B6 F2 AC 53       0855          JP     DLYA
53B9 C9             0860          RET
53BA                0865 *
53BA 32 CA 53       0870 AOUT     STA    ASAVE
53BD DB 5D          0875 AOUTA    IN     CASST          STATUS PORT 5D
53BF E6 01          0880          ANI    01
53C1 CA BD 53       0885          JZ     AOUTA
53C4 3A CA 53       0890          LDA    ASAVE
53C7 D3 5F          0895          OUT    CASDO          DATA OUT PORT 5F
53C9 C9             0900          RET
53CA                0905 *
53CA 00             0910 ASAVE    DB     0
53CB                0915 *CASSETTE UNITS
53CB                0920 CASST    EQU    5DH  STATUS FROM USRT
53CB                0925 CASDI    EQU    5FH  DATA IN PORT
53CB                0930 CASFC    EQU    5CH  FILL CHAR OUT PORT TO USRT
53CB                0935 CASCO    EQU    5EH  COMMAND OUT PORT
53CB                0940 CASDO    EQU    5FH  DATA OUT PORT
53CB                0945 *
53CB 21 C4 52       0950 TL       LXI    H,TITLE        GET TITLE -8 CHAR
53CE 06 08          0955          MVI    B,8
53D0 CD 7B C1       0960 TLA      CALL   CDI
53D3 CD CD 52       0965          CALL   DUL
53D6 FE 0D          0970          CPI    CR
53D8 CA E5 53       0975          JZ     TLB
53DB 77             0980          MOV    M,A
53DC 23             0985          INX    H
53DD 05             0990          DCR    B
53DE C2 D0 53       0995          JNZ    TLA
53E1 CD EE 53       1000          CALL   WAITCR
53E4 C9             1005          RET
53E5 3E 20          1010 TLB      MVI    A,' '
53E7 77             1015 TLC      MOV    M,A
53E8 23             1020          INX    H
```

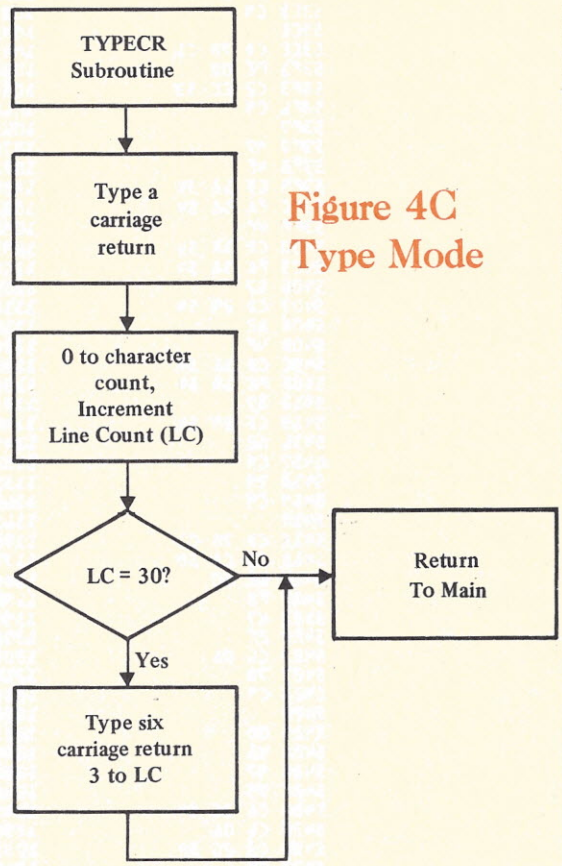


Figure 4C Type Mode

```
53E9 05                 1025        DCR   B
53EA C2 E7 53           1030        JNZ   TLC
53ED C9                 1035        RET
53EE                    1040 *
53EE CD 7B C1           1045 WAITC  CALL  CDI
53F1 FE 0D              1050        CPI   CR
53F3 C2 EE 53           1055        JNZ   WAITCR
53F6 C9                 1060        RET
53F7                    1065 *
53F7 97                 1070 NUM    SUB   A
53F8 4F                 1075        MOV   C,A  0 TO NR
53F9 CD 1A 54           1080        CALL  DIGI
53FC FA 18 54           1085        JM    NUMA
53FF 4F                 1090        MOV   C,A  DA TO NR
5400 CD 1A 54           1095        CALL  DIGI
5403 FA 18 54           1100        JM    NUMA
5406 57                 1105        MOV   D,A
5407 CD 29 54           1110        CALL  TENC
540A 82                 1115        ADD   D  2ND DIGIT
540B 4F                 1120        MOV   C,A  10*DA + DB
540C CD 1A 54           1125        CALL  DIGI
540F FA 18 54           1130        JM    NUMA
5412 57                 1135        MOV   D,A  DC
5413 CD 29 54           1140        CALL  TENC
5416 82                 1145        ADD   D  10*(10*DA+DB)+DC
5417 C9                 1150        RET
5418 79                 1155 NUMA   MOV   A,C
5419 C9                 1160        RET
541A                    1165 *
541A CD 7B C1           1170 DIGI   CALL  CDI
541D CD CD 52           1175        CALL  DUL
5420 DE 30              1180        SBI   30H
5422 F8                 1190        RM    NEG  IF NOT DIGIT
5423 47                 1195        MOV   B,A
5424 2F                 1200        CMA
5425 C6 0A              1205        ADI   10
5427 78                 1210        MOV   A,B
5428 C9                 1215        RET                NEG IF NOT DIGIT
5429                    1220 *WANT C*10 IN A
5429 0C                 1225 TENC   INR   C
542A 41                 1230        MOV   B,C
542B 97                 1235        SUB   A
542C 05                 1240 TENCA  DCR   B
542D CA 35 54           1245        JZ    TENCB
5430 C6 0A              1250        ADI   10
5432 C3 2C 54           1255        JMP   TENCA
5435 C9                 1260 TENCB  RET
5436                    1265 *
5436 0D                 1270 MSGA   DB    0DH
5437 42 4F 4F 4B 20     1275        ASC   'BOOK PROCESSOR '
     50 52 4F 43 45
     53 53 4F 52 20
5446 43 48 41 4E 47     1280        ASC   'CHANGE KEYBOARD TO '
     45 20 4B 45 59
     42 4F 41 52 44
     20 54 4F 20
5459 55 50 50 45 52     1285        ASC   'UPPER PLUS LOWER.'
     20 50 4C 55 53
     20 4C 4F 57 45
     52 2E
546A 0D FF              1290        DW    0FF0DH
546C 0D                 1295 MSGB   DB    0DH
546D 4D 4F 55 4E 54     1300        ASC   'MOUNT WRITE CASSETTE'
     20 57 52 49 54
     45 20 43 41 53
     53 45 54 54 45
5481 FF                 1305        DB    0FFH
5482 0D                 1310 MSGC   DB    0DH
5483 54 49 54 4C 45     1315        ASC   'TITLE? '
     3F 20
548A FF                 1320        DB    0FFH
548B 0D                 1325 MSGD   DB    0DH
548C 43 48 41 50 54     1330        ASC   'CHAPTER? '
     45 52 3F 20
5495 FF                 1335        DB    0FFH
5496 0D                 1340 MSGE   DB    0DH
5497 43 48 41 50 54     1345        ASC   'CHAPTER DONE. CHANGE '
     45 52 20 44 4F
     4E 45 2E 20 43
     48 41 4E 47 45
     20
54AC 54 4F 20 55 50     1350        ASC   'TO UPPER CASE.'
     50 45 52 20 43
     41 53 45 2E
54BA 0D FF              1355        DW    0FF0DH
54BC 0D                 1360 MSGF   DB    0DH
54BD 49 4E 50 55 54     1365        ASC   'INPUT, EDIT OR TYPE? '
     2C 20 45 44 49
     54 20 4F 52 20
     54 59 50 45 3F
     20
54D2 0D FF              1370        DW    0FF0DH
54D4                    1375 *
54D4                    1380 CDI    EQU   0C17BH
54D4                    1385 DISO   EQU   0C214H
54D4                    1390 MSG    EQU   0C16FH
54D4                    1395 MERLN  EQU   0C02BH
```

```
54D4                    1400 DSPLA  EQU   0D006H
54D4                    1405 *
54D4                    1410 *
54D4                    1411 HOME   EQU   0D008H
54D4                    1412 EOM    EQU   0D00CH
54D4                    1415 *
54D4 A7                 1420 GETNS  ANA   A  CLEAR CY
54D5 7D                 1425        MOV   A,L
54D6 93                 1430        SUB   E
54D7 6F                 1435        MOV   L,A
54D8 7C                 1440        MOV   A,H
54D9 9A                 1445        SBB   D
54DA 67                 1450        MOV   H,A
54DB C9                 1455        RET
54DC                    1460 *
54DC                    1470 * CASSETTE READ HEADER
54DC 3E E6              1475 CSRH   MVI   A,0E6H
54DE D3 5D              1480        OUT   CASST
54E0 3E 28              1485        MVI   A,28H
54E2 D3 5E              1490        OUT   CASCO
54E4 CD 2F 55           1495        CALL  CIN
54E7 06 0A              1500        MVI   B,10
54E9 CD 2F 55           1505 CINA   CALL  CIN
54EC FE 7F              1510        CPI   7FH
54EE C2 DC 54           1515        JNZ   CSRH
54F1 05                 1520        DCR   B
54F2 C2 E9 54           1525        JNZ   CINA
54F5 06 08              1530        MVI   B,8
54F7 21 39 55           1535        LXI   H,INT          IN TITLE
54FA CD 2F 55           1540 CINB   CALL  CIN
54FD 77                 1545        MOV   M,A
54FE 23                 1550        INX   H
54FF 05                 1555        DCR   B
5500 C2 FA 54           1560        JNZ   CINB
5503                    1565 *
5503 CD 2F 55           1570 CINC   CALL  CIN
5506 32 41 55           1575        STA   INC  IN CHPT #
5509 CD 2F 55           1580        CALL  CIN
550C 32 42 55           1585        STA   PARIN          #
550F FE EC              1590        CPI   ECH
5511 C0                 1595        RNZ
5512 3E 30              1600 CF     MVI   A,30H
5514 D3 5E              1605        OUT   CASCO
5516 C9                 1610        RET
5517                    1615 * CASSETTE READ TEXT -MOVING
5517 2A BD 52           1620 CSRT   LHLD  ADDRA
551A 11 00 00           1625        LXI   D,0
551D CD 2F 55           1630 CIND   CALL  CIN
5520 77                 1632        MOV   M,A
5521 23                 1635        INX   H
5522 13                 1640        INX   D
5523 FE 10              1645        CPI   EOP
5525 C2 1D 55           1650        JNZ   CIND
5528                    1655 *
5528                    1660 *
5528                    1665 *
5528 EB                 1670 CE     XCHG
5529 22 BF 52           1675        SHLD  NRWDS
552C C3 12 55           1680        JMP   CF
552F                    1685 *
552F DB 5D              1700 CIN    IN    CASST
5531 E6 80              1705        ANI   80H
5533 CA 2F 55           1710        JZ    CIN
5536 DB 5F              1711        IN    CASDI
5538 C9                 1712        RET
5539 20 20 20 20 20     1715 INT    ASC   '
     20 20 20
5541 00                 1720 INC    DB    0
5542 00                 1725 PARIN  DB    0
5543                    1885 *
5543 21 5A 56           2000 EDIT   LXI   H,MSGG
5546 CD 6F C1           2005        CALL  MSG
5549 CD EE 53           2010        CALL  WAITCR
554C                    2015 *
554C                    2020 *
554C 21 82 54           2025        LXI   H,MSGC
554F CD 6F C1           2030        CALL  MSG
5552 CD CB 53           2035        CALL  TL
5555 21 8B 54           2040        LXI   H,MSGD
5558 CD 6F C1           2045        CALL  MSG
555B CD F7 53           2050        CALL  NUM
555E 21 C3 52           2055        LXI   H,CHPTR
5561 77                 2060        MOV   M,A
5562 21 15 57           2061        LXI   H,MSGK
5565 CD 6F C1           2062        CALL  MSG
5568 CD F7 53           2063        CALL  NUM
556B 32 CC 52           2064        STA   PAROUT
556E                    2065 *NEW PARA FROM CASSETTE
556E 3E 0D              2070 ED     MVI   A,CR
5570 CD CD 52           2075        CALL  DUL
5573 CD CD 52           2080        CALL  DUL
5576 21 78 56           2085        LXI   H,MSGH
5579 CD 6F C1           2090        CALL  MSG
557C CD 7B C1           2095        CALL  CDI
557F CD CD 52           2100        CALL  DUL
5582 FE 03              2105        CPI   EOC
5584 CA AC 52           2110        JZ    AZM
```

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CIRCLE 17

```
5587 FE 06              2115          CPI   FC
5589 C2 91 55           2120          JNZ   EDA
558C 3E 7F              2125          MVI   A,7FH
558E C3 99 55           2130          JMP   EDB
5591                    2135 * FINISH READING OF CHPTR #
5591 CD 20 54           2140 EDA      CALL  DIGI+6
5594 0E 00              2145          MVI   C,0
5596 CD FC 53           2150          CALL  NUM+5
5599 21 38 57           2155 EDB      LXI   H,PARN
559C 77                 2160          MOV   M,A
559D CD DC 54           2165 EDC      CALL  CSRH
55A0 3A 42 55           2170          LDA   PARIN
55A3 FE EC              2175          CPI   ECH
55A5 CA AC 52           2180          JZ    AZM
55A8 21 38 57           2185          LXI   H,PARN
55AB BE                 2190          CMP   M
55AC D2 C8 55           2195          JNC   EDG
55AF 21 F0 58           2200          LXI   H,BUFA
55B2 22 BD 52           2205          SHLD  ADDRA
55B5 CD 17 55           2210          CALL  CSRT
55B8 21 F0 58           2215          LXI   H,BUFA
55BB 22 BD 52           2220          SHLD  ADDRA
55BE CD 29 53           2225          CALL  CSW
55C1 21 CC 52           2230          LXI   H,PAROUT
55C4 34                 2235          INR   M
55C5 C3 9D 55           2240          JMP   EDC
55C8                    2245 *PARIN GE PARN
55C8 21 F0 58           2250 EDG      LXI   H,BUFA
55CB 22 BD 52           2255          SHLD  ADDRA
55CE CD 17 55           2260          CALL  CSRT            READ TEXT
55D1 2A 06 D0           2262          LHLD  DSPLA
55D4 3E 41              2265          MVI   A,'A'
55D6 CD 09 C4           2270          CALL  EDITM
55D9 CD C2 C0           2275          CALL  DEOM
55DC 21 38 57           2280          LXI   H,PARN
55DF 3A 42 55           2285          LDA   PARIN
55E2 BE                 2290          CMP   M
55E3 CA EC 55           2295          JZ    EDF
55E6 21 00 57           2300          LXI   H,MSGJ
55E9 CD 6F C1           2302          CALL  MSG
55EC 21 15 57           2305 EDF      LXI   H,MSGK
55EF CD 6F C1           2306          CALL  MSG
55F2 CD 39 57           2307          CALL  PDSP            # IN ASCII
55F5 3E 0D              2309          MVI   A,CR
55F7 CD CD 52           2310          CALL  DUL
55FA CD CD 52           2311          CALL  DUL
55FD 2A 06 D0           2312          LHLD  DSPLA
5600 22 BD 52           2313          SHLD  ADDRA
5603                    2314 *
5603 21 F0 58           2315          LXI   H,BUFA
5606 4E                 2320 EDH      MOV   C,M
5607 CD 14 C2           2325          CALL  DIS0
560A 3E 10              2330          MVI   A,EOP
560C BE                 2335          CMP   M
560D 23                 2340          INX   H
560E C2 06 56           2345          JNZ   EDH
5611 21 17 56           2346          LXI   H,EDI
5614 22 46 D0           2347          SHLD  MRTN
5617 CD 7B C1           2350 EDI      CALL  CDI
561A CD CD 52           2355          CALL  DUL
561D FE 04              2360          CPI   DP
561F CA 3B 56           2365          JZ    EDM
5622 FE 10              2370          CPI   EOP
5624 C2 17 56           2375          JNZ   EDI
5627                    2380 *END PARA
5627 2A BD 52           2385          LHLD  ADDRA
562A EB                 2390          XCHG
562B 2A 06 D0           2395          LHLD  DSPLA
562E CD D4 54           2400          CALL  GETNS
5631 22 BF 52           2405          SHLD  NRWDS
5634                    2440 * CASSETTE WRITE
5634 CD 29 53           2445 EDJ      CALL  CSW
5637 21 CC 52           2450          LXI   H,PAROUT
563A 34                 2455          INR   M
563B 21 D9 56           2460 EDM      LXI   H,MSGI
563E CD 6F C1           2465          CALL  MSG
5641 CD 7B C1           2470          CALL  CDI
5644 FE 59              2475          CPI   'Y'
5646 C2 6E 55           2480          JNZ   ED
5649                    2485 * NEW PARA TO BE ENTERED
5649 3E 0D              2490          MVI   A,CR
564B CD CD 52           2495          CALL  DUL
564E CD CD 52           2500          CALL  DUL
5651 2A 06 D0           2505          LHLD  DSPLA
5654 22 BD 52           2510          SHLD  ADDRA
5657 C3 17 56           2515          JMP   EDI
565A 0D                 2520 MSGG     DB    0DH
565B 4D 4F 55 4E 54     2525          ASC   'MOUNT READ & WRITE CASSETTES'
     20 52 45 41 44
     20 26 20 57 52
     49 54 45 20 43
     41 53 53 45 54
     54 45 53
5677 FF                 2530          DB    0FFH
5678 0D                 2535 MSGH     DB    0DH
5679 45 4E 54 45 52     2540          ASC   'ENTER PARAGRAPH # TO EDIT,'
     20 50 41 52 41
```

```
      47 52 41 50 48
      20 23 20 54 4F
      20 45 44 49 54
      2C
5693  0D                        2545          DB    0DH
5694  20 4F 52 20 43            2550          ASC   ' OR CNTL-F TO FINISH
      4E 54 4C 2D 46                                CHAPTER,'
      20 54 4F 20 46
      49 4E 49 53 48
      20 43 48 41 50
      54 45 52 2C
5681  0D                        2555          DB    0DH
5682  20 4F 52 20 43            2560          ASC   ' OR CNTL-C TO END CHAPTER
      4E 54 4C 2D 43                                IMMEDIATELY
      20 54 4F 20 45
      4E 44 20 43 48
      41 50 54 45 52
      20 49 4D 4D 45
      44 49 41 54 45
      4C 59 20
56D8  FF                        2565          DB    0FFH
56D9  0D 0D                     2570 MSGI     DW    0D0DH
56DB  57 41 4E 54 20            2575          ASC   'WANT TO ENTER NEW PARAGRAPH?
      54 4F 20 45 4E                                Y OR N '
      54 45 52 20 4E
      45 57 20 50 41
      52 41 47 52 41
      50 48 3F 20 59
      20 4F 52 20 4E
      20
56FF  FF                        2580          DB    0FFH
5700  0D                        2581 MSGJ     DB    0DH
5701  42 41 44 20 50            2582          ASC   'BAD PARAGRAPH ENTRY'
      41 52 41 47 52
      41 50 48 20 45
      4E 54 52 59
5714  FF                        2583          DB    0FFH
5715  0D                        2584 MSGK     DB    0DH
5716  50 41 52 41 47            2585          ASC   'PARAGRAPH '
      52 41 50 48 20
5720  FF                        2586          DB    0FFH
5721  0D                        2587 MSGL     DB    0DH
5722  53 54 41 52 54            2588          ASC   'START TYPE PARAGRAPH '
      20 54 59 50 45
      20 50 41 52 41
      47 52 41 50 48
      20
5737  FF                        2589          DB    0FFH
5738  00                        2590 PARN     DB    0
5739                            2596 EDITM    EQU   0C409H
5739                            2597 MRTN     EQU   0D046H
5739                            2598 DEOM     EQU   0C0C2H
5739                            2599 *
5739  3A 42 55                  2600 PDSP     LDA   PARIN
573C  4F                        2605          MOV   C,A
573D  16 64                     2610          MVI   D,100
573F  CD 5D 57                  2615          CALL  DTEN
5742  57                        2620          MOV   D,A   REMAINDER
5743  78                        2625          MOV   A,B
5744  C6 30                     2630          ADI   30H
5746  CD CD 52                  2635          CALL  DUL
5749  4A                        2640          MOV   C,D
574A  16 0A                     2645          MVI   D,10
574C  CD 5D 57                  2650          CALL  DTEN
574F  57                        2655          MOV   D,A
5750  78                        2660          MOV   A,B
5751  C6 30                     2665          ADI   30H
5753  CD CD 52                  2670          CALL  DUL
5756  7A                        2675          MOV   A,D
5757  C6 30                     2677          ADI   30H
5759  CD CD 52                  2680          CALL  DUL
575C  C9                        2685          RET
575D                            2690 *
575D                            2695 * DIV C BY D ANSWER IN B
575D  79                        2700 DTEN     MOV   A,C
575E  06 00                     2705          MVI   B,0
5760  92                        2710 DTENA    SUB   D
5761  FA 68 57                  2715          JM    DTENB
5764  04                        2720          INR   B
5765  C3 60 57                  2725          JMP   DTENA
5768  82                        2730 DTENB    ADD   D
5769  C9                        2735          RET
576A                            2740 *
576A  21 60 58                  2800 TYPE     LXI   H,MSGM
576D  CD 6F C1                  2805          CALL  MSG
5770  CD EE 53                  2810          CALL  WAITCR
5773  21 82 54                  2815          LXI   H,MSGC
5776  CD 6F C1                  2820          CALL  MSG   TITLE
5779  CD C8 53                  2825          CALL  TL
577C  21 21 57                  2826          LXI   H,MSGL
577F  CD 6F C1                  2827          CALL  MSG
5782  CD F7 53                  2828          CALL  NUM
5785  32 38 57                  2829          STA   PARN
5788  21 75 58                  2830          LXI   H,MSGN
578B  CD 6F C1                  2835          CALL  MSG   LINE IN TYPEWRTR
578E  CD F7 53                  2840          CALL  NUM
5791  32 A2 58                  2845          STA   NRLN
```

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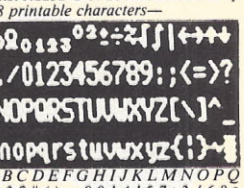

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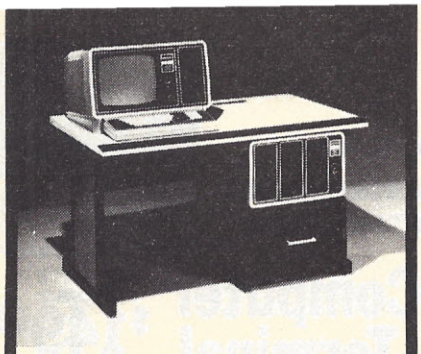

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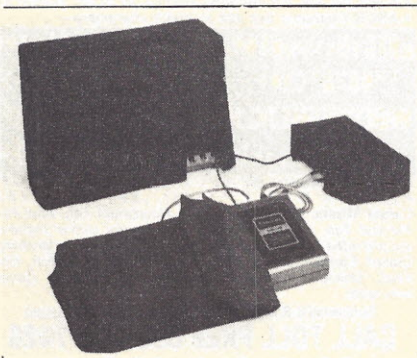

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CIRCLE 20

```
5794 97
5795 32 A3 58
5798 32 A4 58
5798
5798 CD DC 54
579E 3A 42 55
57A1 FE EC
57A3 CA 42 58
57A6 21 F0 58
57A9 22 BD 52
57AC CD 17 55
57AF 3A 42 55
57B2 21 38 57
57B5 96
57B6 FA 98 57
57B9 CD A8 58
57BC CD 57 58
57BF FE 0D
57C1 CA FA 57
57C4 32 A5 58
57C7 FE 10
57C9 CA 98 57
57CC CD CB 58
57CF FE 20
57D1 C2 BC 57
57D4 21 A1 58
57D7 7E
57D8 FE 06
57DA DA BC 57
57DD
57DD 2A A3 58
57E0 23
57E1 22 A3 58
57E4 3A A1 58
57E7 FE 3C
57E9 DA BC 57
57EC CD A8 58
57EF CD 57 58
57F2 FE 20
57F4 CA BC 57
57F7 C3 BF 57
57FA
57FA CD 57 58
57FD FE 0D
57FF C2 08 58
5802 CD A8 58
5805 C3 FA 57
5808
5808 32 A6 58
580B 3E 20
580D 21 A5 58
5810 BE
5811 C2 1A 58
5814 3A A6 58
5817 C3 C4 57
581A
581A
581A CD CB 58
581D 3A A5 58
5820 FE 2E
5822 C2 2A 58
5825 3E 20
5827 CD CB 58
582A 2A A3 58
582D 23
582E 22 A3 58
5831 3A A1 58
5834 FE 3C
5836 DA 3C 58
5839 CD A8 58
583C 3A A6 58
583F C3 C4 57
5842
5842 21 8F 58
5845 CD 6F C1
5848 3A A4 58
584B CD 4C C2
584E 3A A3 58
5851 CD 4C C2
5854 C3 B4 52
5857
5857 2A BD 52
585A 7E
585B 23
585C 22 BD 52
585F C9
5860
5860 0D
5861 4D 4F 55 4E 54
     20 52 45 41 44
     20 43 41 53 53
     45 54 54 45
5874 FF
5875 0D

2850          SUB   A
2855          STA   NRW
2856          STA   NRW+1
2860 * NEW PARAGRAPH
2865 TA       CALL  CSRH            READ HEADER
2870          LDA   PARIN
2875          CPI   ECH
2880          JZ    TZ
2885          LXI   H,BUFA
2890          SHLD  ADDRA
2895          CALL  CSRT
2896          LDA   PARIN
2897          LXI   H,PARN
2898          SUB   M
2899          JM    TA
2900          CALL  TYPECR
2905 TB       CALL  CINN
2910 TC       CPI   CR
2915          JZ    TF
2920 TD       STA   CH
2925          CPI   EOP
2930          JZ    TA
2945 TE       CALL  OUTCH
2955          CPI   SPACE
2960          JNZ   TB
2965          LXI   H,J
2970          MOV   A,M
2975          CPI   6   CY=1 IF J LT 6
2980          JC    TB
2985 *
2990          LHLD  NRW
2995          INX   H
2996          SHLD  NRW
3000          LDA   J
3005          CPI   60
3010          JC    TB
3015          CALL  TYPECR          CY=1 IF 50 LT J
3020          CALL  CINN
3021          CPI   SPACE
3022          JZ    TB
3023          JMP   TC
3025 *
3030 TF       CALL  CINN
3035          CPI   CR
3040          JNZ   TG
3045          CALL  TYPECR
3050          JMP   TF
3055 *
3060 TG       STA   NCH
3065          MVI   A,SPACE
3070          LXI   H,CH
3075          CMP   M
3080          JNZ   TH
3085          LDA   NCH
3090          JMP   TD
3095 *
3100 *
3105 TH       CALL  OUTCH
3106          LDA   CH
3107          CPI   '.'
3108          JNZ   THA
3109          MVI   A,SPACE
3110          CALL  OUTCH
3111 THA      LHLD  NRW
3115          INX   H
3116          SHLD  NRW
3120          LDA   J
3125          CPI   60
3130          JC    THB
3135          CALL  TYPECR
3140 THB      LDA   NCH
3145          JMP   TD
3150 *
3155 TZ       LXI   H,MSG0
3160          CALL  MSG
3165          LDA   NRW+1
3166          CALL  DBYT
3167          LDA   NRW
3170          CALL  DBYT
3175          JMP   AZMA
3180 *
3185 CINN     LHLD  ADDRA
3190          MOV   A,M
3195          INX   H
3200          SHLD  ADDRA
3205          RET
3210 *
3215 MSGM     DB    0DH
3220          ASC   'MOUNT READ CASSETTE'
3225          DB    0FFH
3230 MSGN     DB    0DH
```

```
5876 54 59 50 45 57      3235          ASC   'TYPEWRITER LINE NUMBER? '
     52 49 54 45 52
     20 4C 49 4E 45
     20 4E 55 4D 42
     45 52 3F 20
588E FF                  3240          DB    0FFH
588F 0D                  3245 MSG0     DB    0DH
5890 4E 55 4D 42 45      3250          ASC   'NUMBER OF WORDS '
     52 20 4F 46 20
     57 4F 52 44 53
     20
58A0 FF                  3255          DB    0FFH
58A1                     3260 *
58A1 00                  3265 J        DB    0  INDEX OF CH ON LINE
58A2 00                  3270 NRLN     DB    0
58A3 00 00               3275 NRW      DW    0
58A5 00                  3280 CH       DB    0
58A6 00                  3285 NCH      DB    0
58A7 1E                  3290 MAXLN    DB    30
58A8                     3295 SPACE    EQU   20H
58A8                     3300 *
58A8 0E 0D               3305 TYPEC    MVI   C,CR
58AA CD 00 F7            3310          CALL  TYPER
58AD 97                  3315          SUB   A
58AE 32 A1 58            3320          STA   J
58B1 21 A2 58            3325          LXI   H,NRLN
58B4 34                  3330          INR   M
58B5 3A A7 58            3335          LDA   MAXLN
58B8 BE                  3340          CMP   M
58B9 C0                  3345          RNZ
58BA 06 06               3350          MVI   B,6
58BC 0E 0D               3355 TCA      MVI   C,CR
58BE CD 00 F7            3360          CALL  TYPER
58C1 05                  3365          DCR   B
58C2 C2 BC 58            3370          JNZ   TCA
58C5 3E 03               3375          MVI   A,3
58C7 32 A2 58            3380          STA   NRLN
58CA C9                  3385          RET
58CB                     3390 *
58CB 47                  3395 OUTCH    MOV   B,A
58CC DE 00               3400          SBI   0
58CE FA E7 58            3405          JM    PA
58D1 DE 41               3410          SBI   41H
58D3 FA EC 58            3415          JM    PB
58D6 DE 1A               3420          SBI   1AH
58D8 F2 EC 58            3425          JP    PB
58DB C6 7B               3430          ADI   7BH
58DD 4F                  3435 TYP      MOV   C,A
58DE CD 00 F7            3440          CALL  TYPER
58E1 21 A1 58            3445          LXI   H,J
58E4 34                  3450          INR   M
58E5 78                  3455          MOV   A,B
58E6 C9                  3460          RET
58E7 E6 7F               3465 PA       ANI   7FH
58E9 C3 DD 58            3470          JMP   TYP
58EC 78                  3475 PB       MOV   A,B
58ED C3 DD 58            3480          JMP   TYP
58F0                     3485 TYPER    EQU   0F700H
58F0                     3486 DBYT     EQU   0C24CH
58F0                     3487 BUFA     DS    710H
6000 00                  3488 ENDW     DB    0
```

SYMBOL TABLE

ADDRA	52BD	AOUT	53BA	AOUTA	53BD	ASAVE	53CA	AZA	5200
AZE	5256	AZG	526A	AZJ	527A	AZK	5287	AZM	52AC
AZMA	52B4	BUFA	58F0	CASCO	005E	CASDI	005F	CASDO	005F
CASFC	005C	CASST	005D	CDI	C17B	CE	5528	CF	5512
CH	58A5	CHPTR	52C3	CIN	552F	CINA	54E9	CINB	54FA
CINC	5503	CIND	551D	CINN	5857	CR	000D	CRMEM	C0C2
CSRH	54DC	CSRT	5517	CSW	5329	DBYT	C24C	DEOM	C0C2
DIGI	541A	DISO	C214	DLY	53AA	DLYA	53AC	DLYB	53AF
DP	0004	DSPLA	D006	DTEN	575D	DTENA	5760	DTENB	5768
DUL	52CD	DULA	52DD	ECH	00EC	ED	556E	EDA	5591
EDB	5599	EDC	559D	EDF	55EC	EDG	55C8	EDH	5606
EDI	5617	EDIT	5543	EDITM	C409	EDJ	5634	EDM	5638
ENDW	6000	EOC	0003	EOM	D00C	EOMA	52C1	EOP	0010
FC	0006	GETNS	54D4	HOME	D008	INC	5541	INT	5539
J	58A1	LDR	539E	LPA	533A	LPB	5348	LPC	536F
LPCA	5388	LPCB	5389	LPD	5394	MAXLN	58A7	MERLN	C02B
MRTN	D046	MSG	C16F	MSGA	5436	MSGB	546C	MSGC	5482
MSGD	5488	MSGE	5496	MSGF	54BC	MSGG	565A	MSGH	5678
MSGI	56D9	MSGJ	5700	MSGK	5715	MSGL	5721	MSGM	5860
MSGN	5875	MSGO	588F	NCH	58A6	NRLN	58A2	NRW	58A3
NRWDS	528F	NUM	53F7	NUMA	5418	OUTCH	58CB	PA	58E7
PARIN	5542	PARN	5738	PAROU	52CC	PB	58EC	PDSP	5739
SPACE	0020	TA	5798	TB	57BC	TC	57BF	TCA	58BC
TD	57C4	TDUL	52EA	TE	57CC	TENC	5429	TENCA	542C
TENCB	5435	TF	57FA	TG	5808	TH	581A	THA	582A
THB	583C	TITLE	52C4	TL	53CB	TLA	53D0	TLB	53E5
TLC	53E7	TYP	58DD	TYPE	576A	TYPEC	58A8	TYPER	F700
TZ	5842	WAITC	53EE						

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CIRCLE 21

BY THOMAS A THROOP

The Complex Strategy of Bridge

I recently received an interesting letter from Alan Truscott, an internationally known bridge expert and author who is presently the Bridge Editor of the *New York Times*. With respect to my bridge playing program discussed in the February and July columns, Alan Truscott writes:

"Computer bridge is of course much harder to deal with than computer chess because of the human, stylistic and psychological factors.

"I can see that your program is far ahead of any earlier efforts, and I congratulate you on it. I'd like to see it in operation some time.

"There are obviously some artificialities in your arrangement, but I can see that they would be difficult, or perhaps impossible, to eliminate. One is the fact that the absence of bidding deprives the declarer of a number of normal indications. Another is the question of defenders' agreements. In practical play the defenders have agreements about opening leads and signals which the declarer is entitled to know about and utilize. Your program, I suspect, does not provide for this.

"Thirdly, there is the problem of objective. In real life the declarer's objectives vary, or he may have several objectives in mind. He is also affected by the type of scoring in use."

I am pleased to see that Alan Truscott shares my opinion that computer bridge is much more difficult than computer chess, which I stated in my August column. As mentioned in that column, the current chess programs simply investigate as many moves for as many moves ahead as time and/or computer memory permits. The cleverness of the programs consists mostly of two things. First, various "pruning" techniques are used to eliminate consideration of as many "probably" poor moves as possible. The danger here is, of course, that a poor looking move will actually lead to a winning result. Second, the remaining key to good play is the quality of the scoring function, which gives each move under consideration a score. The move emerging with the highest score among all of those considered is the chosen computer move. What the computer chess programs do not do is play chess the way a human being does in terms of "creating" innovative lines of play or "applying" certain concepts in recognized situations.

In contrast, the bridge algorithms I have implemented and am currently developing are designed to play the game in the same manner as a human player by creative thinking or the application of known techniques in recognized situations. This task is much more difficult than the tree-searching and resulting position scoring of the chess playing algorithms.

Another point should quickly be mentioned. Chess is a game of perfect information. The location of all of the pieces is known to both players. Thus, a chess program has total information on the game position on which to base its analysis. On the other hand, the location of all of the cards in a bridge deal only becomes known as the play of the deal progresses. Thus, a bridge program has imperfect information on the card locations on which to base its analysis!

Alan Truscott attributes the greater difficulty to "human, stylistic and psychological factors". While I am not sure exactly what he has in mind by the first of these factors as distinguished from the other two, I think in his own way he is considering the problem of imperfect information referred to above. A good player will form conclusions about the locations of the unseen cards by interpreting the bids and plays of other cards made by the other players, but this is often a subjective process.

Regarding the "stylistic" factor, there are numerous different bidding systems and styles, as well as various methods of defensive signaling. Good bridge players learn to deal successfully with the various systems and styles employed by their opponents.

Concerning the "psychological" factor, good players will occasionally make a bluffing or "psychic" bid or a deceptive play calculated to mislead one or both opponents at the risk of misleading their partner.

These factors mentioned by Alan Truscott present to the bridge program developer a range of problems not encountered by the chess program developer. In fact, the first bridge programs are not likely to fully address these problems.

As Alan Truscott next mentions, a good playing program should consider the bidding when planning its play as declarer. The problem of having an analysis of the bidding contribute intelligence to the playing algorithms is again a problem not faced by the chess program developer.

	West	Computer North (Dummy)	East	Computer South (Declarer)
Trick 1	2C	5C	JC	**KC**
2	KH	**AH**	3H	QH
3	3D	2H	5H	**9H!**
4	4C	7C	8H	**JH**
5	2S	5S	9S	**KS**
6	4S	**AS**	JS	TS
7	TC	**AC**	3C	4D
8	6S	QS	**TH**	3S
9	7D	**KD**	TD	8D
10	8S	7S	6C	**4H**
11	QC	9C	8C	**7H**
12	9D	2D	5D	**6H**
13	QD	**AD**	6D	JD

Tricks N-S (computer): 12 Tricks E-W: 1

Then Alan Truscott raises the question of the defenders' agreements. In practice the declarer is entitled to know about agreements on opening leads and signals. A good playing program should recognize and act properly upon the defensive plays made in accordance with these agreements. Here again this problem is not faced by the chess program developer.

Finally, Alan Truscott comments on the different objectives a declarer may have and on the different types of scoring. Once the final contract has been established by the bidding, the declarer must decide whether to try to just make the contract or to try for overtricks. Similarly, the defenders must each decide whether to try to just barely beat the contract with a one trick set or try to defeat the contract by several tricks. In a tournament these decisions are based on likely results at other tables and on the type of scoring for the event involved. These problems do not confront the chess program developer.

Alan Truscott was also interested in another example of my bridge playing program's performance. Here is another hand, for your interest as well as his:

COMPUTER NORTH
(Dummy)
♠ AQ75
♥ A2
♦ AK2
♣ A975

WEST	EAST
♠ 8642	♠ J9
♥ K	♥ 10853
♦ Q973	♦ 1065
♣ Q1042	♣ J863

COMPUTER SOUTH
(Declarer)
♠ K103
♥ QJ9764
♦ J84
♣ K

Looking at the North-South cards, 6 hearts is a very reasonable contract. Even 7 hearts, while ambitious, would not be unreasonable.

Giving my program the contract of 6 hearts, the play of the deal is as shown in the tableau on the preceding page.

The principal problem for the computer program, as it would be for a human declarer, is the play of the trump suit. After winning the opening club lead with the king of clubs, the computer program finesses West for the king of hearts by leading the queen from declarer's hand. West plays the king, and dummy's ace wins. At trick 3 the computer program then leads the 2 of hearts from dummy and correctly finesses with the 9 of hearts. This is successful, but alas, West shows out, which means there is no overtrick. However, the computer program successfully makes the slam contract, losing only to the 10 of hearts. Declarer's losing diamond is discarded on dummy's ace of clubs.

Bridge Survey

In an effort to bend this bridge column toward the specific interests of our readers, we ask that you kindly respond to this survey.

1. Are you playing bridge now and how many years have you played?
2. Do you belong to a bridge club or other bridge organization and how often do you play?
3. Have you ever played duplicate bridge? If so, how often?
4. Do you follow a recognized bidding system? If so, which one?
5. How many master points, if any, do you now have?
6. What is the most important event or tournament in which you have ever participated? Where and when? How did you finish?
7. In your opinion who are the best bridge players in the world?
8. Do you regularly read a bridge column in some publication? Whose?
9. Who is your favorite bridge-book author?
10. Do you know anyone who has written a computer bridge program?
11. If we were to conduct a computer-bridge tournament sometime in the next 12 months, would you consider entering your program?
12. Do you own a PET, Apple, TRS-80 or some other microcomputer?
13. Do you have a copy of the Duisman program? How many hands have you played and which have you found the most interesting? Least?
14. Do you own a bridge program other than the Duisman? Whose?

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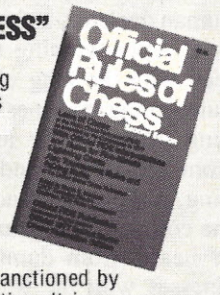

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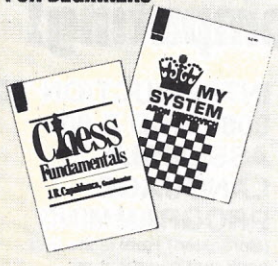

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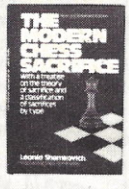

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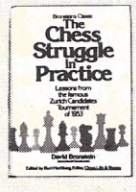

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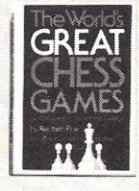

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The Computer Attacks Moravec Problem

Donald Michie is Professor of Machine Intelligence at the University of Edinburgh, a post he has held since 1967. During a distinguished career, he has lectured extensively on the subject of machine intelligence and perception and has made a number of tours as visiting lecturer to many universities in the United States and the Soviet Union. Author of several books plus numerous technical papers and articles, Prof. Michie has been chief editor of the "Machine Intelligence Series" since its inception in 1967. (A newly-printed publication, "Machine Intelligence" — edited jointly by J. Hayes, L.I. Mikulich and D. Michie — is scheduled for appearance shortly. Publishers of the book, which includes a four-chapter section on machine analysis of chess, are Halstead Press of England and John Wiley, U.S.)

Prof. Michie is also widely known for his regular columns in the computing press on artificial intelligence and computer chess. The following discussion by Michie of a Moravec problem (1927) appearly in the May 10, 1979 issue of *Computer Weekly* and it is reprinted here with thanks to Professor Michie.

"Black (see figure A) has awe-inspiring pawn-promotion threats. Yet White can draw. How?

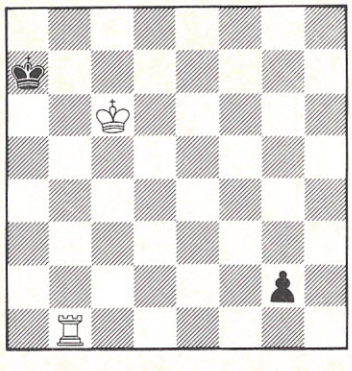


Figure A

"First consider the problem as it appears to a machine system devoid of understanding, i.e. unequipped with any concepts beyond the bare rules of the game. Such a system must proceed by exhaustive analysis. How much blind search must it do?

"Black can spin things out for 22 moves (44-ply). At each step White's choices average about 20 legal moves and Black's range from one to five — many more in "stupid" branches of the look-ahead in which one or more pawns have queened (in brute-force lookahead such variations must be included). So the total number of variations to be searched is something like $20^{14} \times 5^{14} \times 10^{28}$! **Conclusion:** in the absence of heuristics, the position defies analysis.

"I recently had the instructive experience of watching the response to this problem of the British chess program Master, developed at Harwell by Peter Kent and John Birmingham. When set to search only 5-ply deep, the program soon made a false step and was lost. But when re-set to 7-ply it unrolled the solution unerringly. The concepts embedded in its evaluation function which it found relevant were the following:

1. Checkmate.
2. Repetition of position.
3. Move kings together in the end game.
4. Positional value of kings is high in the middle of the board, low at the sides and lower still in the corners.
5. Attack and control of squares next to the opponent's king.
6. Checking the king.
7. Opposition of kings.
8. Passed pawns increase in value as they advance. A passed pawn on the seventh rank is worth at least a knight if the square in front of it is not attacked or blocked.
9. Threatening, controlling and blocking squares in front of passed pawns.
10. Threatening and controlling squares containing passed pawns.
11. Pawns on the eighth rank are converted to queens and take the material value of a queen.
12. Threats to queens, rooks and pawns and swap-offs on the squares containing these pieces.
13. Distance of kings from the pawns.
14. X-rays and skewers.
15. Kings outside the square of passed pawns.

"The following account is based on Peter Kent's comments: While the above elements all had some part in the ordering of moves, most of the moves were decided by a very small subset together with an algorithm which tells the machine to keep searching until a 'reasonable' move is found (if one exists). 'Reasonable' is defined by numerical limits which it decides for itself and is based on the value at the base of the tree and the backed-up score.

"In this example every move was dominated by the need to prevent the pawn's queening. When there were several alternatives for the given depth of look-ahead it selected moves that forced repetition or kept the opponent's kings away from the center of the board and the two kings close together. Elements 1, 2, 3, 6 plus material value including 4 and 11 are probably sufficient to solve the problem. A tree searcher is much more robust than a knowledge-based program but is less precise. It will often find the correct move even if the knowledge it does have tells it to search in the wrong area initially.

"White's 19th move in Master's solution to the above problem is a good example. White's correct move is R-R8, but this is against most of Master's evaluation terms. It leaves the squares in front of the passed pawn uncontrolled. It does not threaten the passed pawn. It removes control from a square next to the opponent's king. Even worse — in the lookahead it finds that it forces the opponent's king to run away from the corner and towards its pawn. Of the 22 posible moves only two have a lower score, and yet Master found the correct move because it was the only possible move. The cost of this

bad advice, however, was an increase in the number of positions examined from an average of about 15,000 to 125,000.

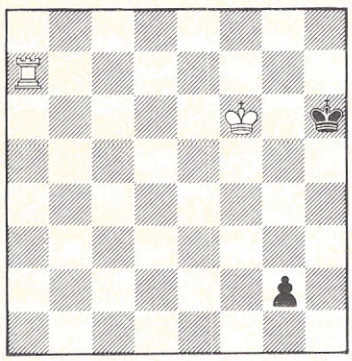


Figure B

"The 44-ply calculation used earlier was based on a much shorter solution than the one found by Master (and given by the study's composer Moravec). Can the reader find it?"

ICCA News

The International Computer Chess Association has been in existence for more than a year and its membership list has grown to 185. With editorial contributors reporting from all parts of the world, including Russia, Australia, the Netherlands, etc., the ICCA newsletter has become an international forum for discussion of many facets of computer chess. The upcoming fourth newsletter is scheduled for November, following the 10th Annual North American Computer Chess Championship in Detroit. Any non-member who would like to get this important November newsletter, which promises to be the most informative and most newsworthy issue to date, should sent $10 (a year's membership dues to ICCA; Vogelback Computing Center; Northwestern University; Evanston, IL 60201.

Chess for Calculator

Texas Instruments reportedly has a new chess program that runs on their programmable (TI-59) calculators. After testing by TI's analysts, the program will be offered to members of TI's PPX group and the item should be appearing in the current PPX-59 catalog. Readers who have access to this TI program are invited to send in a sample game.

OSTRICH IV Meets the BLACK KNIGHT

By M.M. Newborn, (School of Computer Science, McGill)

Initial seedings in ACM's Ninth North American Chess Championship, held last December in Washington, placed OSTRICH IV sixth and BLACK KNIGHT seventh. OSTRICH had earned a 1508 Quebec Chess Federation provisional rating based on play in the 1978 Montreal Open. BLACK KNIGHT's record indicated a similar level of play. The two met in Round 3 of the tournament and an interesting game ensued. The lead changed hands several times until BLACK KNIGHT unnecessarily pinned its own Knight on move 35.

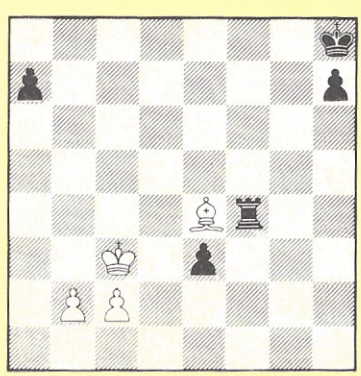
OSTRICH IV, running on a Data General Nova 3 at McGill University, was searching trees of about 15,000 positions per move. On nine of the seventy-six moves, OSTRICH IV searched trees in excess of 20,000 positions; on nine other moves, it searched fewer than 5,000 positions. BLACK KNIGHT was running on a powerful UNIVAC 1100/40 located in Washington, D.C. Carl Hammer of UNIVAC was in charge of running the program. Dr. Hammer, a distinguished member of the computer science field, has had a long-standing interest in computer chess.

What follows is a documentation of the game, plus a sample of the printout from the computer, plus an analysis of the game based on the printout.

White-*BLACK KNIGHT*

Black-OSTRICH

1	P-K4	P-QB3
2	P-Q4	P-Q4
3	PxP	QxP (a)
4	N-QB3	Q-QR4
5	N-B3	P-K3
6	P-QR3	B-Q3
7	B-Q2	Q-Q1
8	N-K4	B-K2
9	B-Q3	P-KB4 (b)
10	N-B3	N-KB3
11	O-O	O-O
12	R-K1	P-QB4
13	B-K3	PxP
14	BxP/Q4	N-QB3
15	B-N5	Q-B2
16	B-B4	R-K1
17	RxP	BxR
18	BxBch	K-R1 (c)
19	N-KN5!	NxB
20	QxN	B-QB4
21	Q-KR4	Q-N3
22	N-R4	Q-B2
23	Q-QB4	BxP+! (d)
24	K-B1	QxQ
25	BxQ	R/K1-QB1
26	B-N3	B-R5
27	N-KB3	P-QN4
28	N-B3	P-N5? (e)
29	PxP	R/R1-N1
30	NxB	RxP
31	R-R4	RxR
32	BxR	R-QN1 (f)
33	B-N3	N-K5
34	NxN	PxN
35	N-B5??	R-KB1
36	B-K6	P-N3
37	P-KN4	PxN
38	K-K1	PxP
39	BxP	P-K6
40	K-Q1	R-KB8+
41	K-K2	R-B7+
42	K-Q3	R-Q7+
43	K-B3	RxP/R7
44	B-B5	R-B7
45	B-K4	R-B5 (g)
46	B-Q3	R-B7



Position after Black's 45th move

47	P-N4	R-R7	57	B-B3	R-B7	67	K-Q4	K-Q3
48	P-N5	K-N2	58	B-K4	R-B5	68	P-B7	KxP
49	B-K4	R-Q7	59	B-Q5?	P-K7	69	K-B5	P-R5
50	B-B3	P-KR3	60	K-Q2	R-Q5+	70	K-B4	P-R6
51	B-N4	K-N3	61	KxP	RxB	71	K-B5	P-R7
52	B-B3	R-B7	62	P-B4	R-Q5	72	K-B4	P-R8=Q
53	B-N7	R-Q7	63	P-B5	R-QN5	73	K-Q3	K-Q3
54	B-K4+	K-B3	64	K-Q3	P-KR4	74	K-K3	RxP
55	B-B3	R-B7	65	P-B6	K-K3	75	K-Q4	R-N6
56	B-B6	R-Q7	66	K-B3	R-N8	76	K-B4	Q-Q4 Mate

Annotations by Professor Newborn

(a) OSTRICH IV plays the first three moves from its book. The book was added to the program during the summer of 1979 by Ilan Vardi, a mathematics student at McGill and a strong chess player. The Caro-Kann was selected because it was felt the other programs and players with rating in the 1400-1600 USCF level would be less familiar with this opening than with others. The third move, however, indicated there was a bug in the book! The usual move is PxP.

(b) OSTRICH IV is programmed to attack with its Pawns. In particular, attacking Pawn-moves at the *first* level in the tree is given extra credit. Computers are somewhat slow to advance Pawns, and chasing opponents' pieces seems to be a good reason for advancing them. It's like a forced savings plan! Sometimes, however, the overall Pawn structure is weakened and King safety is jeopardized as is the case here.

(c) Here OSTRICH IV carried out an additional move iteration. This is one of the advantages of an iteratively deepening search: in a position where the computer has only a few moves it can usually search deeper than otherwise. These are positions in which the computer is normally in trouble (in check, for example), and the extra level of search is often helpful. In the move evaluation, the King preferred R1 to B1 because, until the endgame, the King is encouraged to stay as far away from the middle of the board as possible. (This algorithm has since been modified: now all black squares have equal weighting.)

(d) OSTRICH IV's best move turning the game around. White cannot play K × B because Black then wins the Queen with 24. . .N−N+.

(e) The Pawn attacking algorithm. This is a classic OSTRICH move in the sense of Turing. OSTRICH sees 28 N-QB3 P-KN4 and although it examined 29 P-KN3, it fails to see that White wins the Black Bishop for a Pawn. This move 29 P-KN3 is "too quiet." Any move other than 27. . .P-QN4 will lose the Bishop at the fourth play and OSTRICH sees this. OSTRICH is now in trouble.

(f) OSTRICH feels it is down one Pawn in material and behind 2173 points in position. This is mainly due to (1) White's passed Queen's Bishop's Pawn and (2) Black's isolated Rook Pawn.

(g) Eventually OSTRICH IV will realize it must push the King Rook's Pawn and bring its own King into action. The algorithm used to keep the King on the side of the board early in the game has been reversed now that material has dropped to a low enough level.

Analysis of Computer Printout

The OSTRICH IV program continually prints out information on every position evaluation. Here, it describes move evaluations for the fourth move:

Q/Q4-KB4 0 −511
Q/Q4-QR4 P/Q4-Q5 0 −565
Q/Q4-Q2 B/QB1-KB4 P/QN2-QN4 0 −549
Q/Q4-QR4 P/KR2-KR4 N/KN1-KB3 P/QR-QR4 0 −551 184
4 DP 4 7 PO 3 T 15225 SGN 1369 N 4562 R O A 12 TIME 184 / 576/ 144

(1) Four iterations were carried out at increasing depths. On the first one, Q-KB4 was found best; on the second, Q-QR4; on the third, Q-Q2; and on the fourth, Q-QR4.

(2) OSTRICH IV assigns the position a score of 0, −551 and indicates the move took 184 seconds of computing time. The 0 indicates there is no material difference on the board; the −551 indicates OSTRICH is 551 points behind in position.

(3) The move number is 4.

(4) DP: Search depth on final iteration ranged between 4 and 7 plies.
(5) PO: The move Q-QR4 was 3rd on the ply 1 moves list.
(6) T: 15225 terminal nodes were scored.
(7) SGN: (ignore)
(8) N: 4562 nonterminal nodes were scored.
(9) R: The material score assigned to the root of the tree from previous iteration.
(10) A: 12 moves were searched at ply 1 on the last iteration. There were more on the board but OSTRICH IV was satisfied with its score and it had already taken 4/3 of its AVEMT. (Average Move Time).
(11) TIMES (in seconds): 184/576/144 indicates the average move time (@ AVEMT=144), a total of 144×3=576 allotted time consumed thus far and a total of 184 real seconds consumed thus far. The program uses the fact that it is ahead of schedule to search longer, and thus possibly deeper, on succeeding moves.

The evaluation for the fourth move differs dramatically from the 75th move:

P/QR2-QR4 15 3070
P/QR2-QR4 K/Q4-QB4 15 2653
R/QN4-QN6 K/Q4-QB4 Q/KR8-Q4 32760 −4
R/QN4-QN6 K/Q4-QB4 Q/KR8-Q4 32760 −4
R/QN4-QN6 K/Q4-QB4 Q/KR8-Q4 32760 −4
R/QN4-QN6 K/Q4-QB4 Q/KRB-Q4 32760 -4 28
75 DP 6 9 PO 1 T 2082 SGN 30 N 45 R
32760 A 43 TIME 10674 / 10800/ 144

Here, the computer indicates that it is 15 points ahead in material difference, and 2653 points ahead on position, depending on how White will move. The arbitrary high value of 32760 is assigned to indicate a mate. Here, OSTRICH sees a mate on its 76th move.

Compushvili

(The following story by Ephraim Kishon appeared in the Jerusalem Post Nov. 24, 1978, and was an English translation from the Hebrew newspaper "Maariv". Ephraim Kishon is considered to be Israel's leading humorist and is a well-known satirical writer, with 30 books and plays to his credit. For the past 25 years, Ephraim has been writing a daily satirical column in Israel's daily "Maariv". The reactions of Ephraim to a chess computer appeared in one of those columns and are reprinted here with permission of the author).

My Uncle Egon arrived from America bearing presents. I peeled the paper off mine and it turned out to be a flat box the size of a paperback, embellished with 16 shiny push-buttons.

"Something to keep you from getting bored," said Uncle Egon grinning. "A chess-playing computer."

My youthful love for the game revived on sight. Every decent satirist falls in love with chess at least once in his life, the way politicians go for poker. Some time in the 1940's I even wrote a remarkably fat chess handbook, and was well on the way to becoming an addict when Adolf intervened and drew my attention to some other aspects of black and white.

To be brief, I sent Uncle Egon off and since then I've been taken up with my whizzbox 36 hours a day. We generally start playing in the morning as I shave, and finish a couple of minutes after I go to bed with the box in my arms. Sex? Possibly. All I know is that I'm deeply attached to my pretty playmate with the darling buttons.

And he's not merely pretty, he's smart as well. He gives a little tweet after every move like a Kolbotek chicken - one tweet if I've made the right move according to his lights, two if I've missed. His own answer appears in red on a small built-in screen.

An American Djindjihashvili of 10 x 20. He doesn't play well - he plays superbly. He's got character too and is a good loser. Sometimes when he realizes I'm about to beat him he gives me a sad blink on his screen; "Game's up." When he sees *he* is winning, though, he gets an insolent look in his eye and all but gives me a Bronx cheer.

He's American, as I said.

And when the going gets rough he asks for time out, just like a human being. I wonder when he'll start talking Georgian.

My wife thinks I'm crackers. She's just jealous, of course. All she knows about chess is yoga and yoghurt.

What makes a match with "Compushvili" such a pleasure is that you can discreetly change his mental ratio in the middle of a game. He operates on various levels. At one level he only thinks a second and plays like a dummy. Give him more time and he ponders his move for a full hour and is positively murderous. I generally put him on three minutes. Why tire him out?

If he gets cheeky and tries to play me some of the mean tricks they fed him in America I reduce him in rank like Dreyfus and checkmate the little idiot with a tiny smile on my lips.

It's a very humane sort of arrangement. Pity it's not in general use. Think what a boost it would have given Korchnoi if he could have got up in the middle of that final match and twirled a button on Karpov's coat, turning the champ into a fumbling tyro with a flick of the wrist.

And on top of it all I can retrace my steps and correct a false move with the help of a special button, whereas he, my "Vili", cannot. Why? Because Man is still superior to Machine.

Hence I always win. Lately I've got into the habit of talking to "Vili" as we play: "Nu?" I sneer at him. "What'll you do now, you silly little toy?"

Nothing hurts his feelings as much as to be called a toy, but I'm not afraid of anyone 10 x 20.

"Mate in three, what?" I snarl. "So that's your little game, eh? Not *my* king you won't!"

And I take him down a few minutes and God save the king. Great fun it is, playing like that, though not everyone shares my opinion. My wife, for instance, gave me notice last week that I'd have to choose betwen her and "that dumb computer." A proper ultimatum it was: she'd leave me, she said, and go home to her daddy.

But I won't budge. I have watched the launching of the first rocket to the moon, I live in peace with colour TV, I've nearly grasped the principle of the zipper, and somehow I even understand how a computer works, more or less, since it's based on mathematical rules. But "Vili's" based on rooks. "Vili" can give you mate, mate!

The mind boggles.

I mean, how the blazes can a flat box know that if its knight moves to the center, its queen will have to retreat, and that will expose its king to my bishop three moves hence, and then it won't be able to castle?

I'm just asking: how do they feed a computer with such data? How? Do they tell it in the factory: "Listen 'Vili,' don't make any rash moves with your knight before you've got your king safe." and 'Vili' says: "Leave it to me, boss, I wasn't made yesterday?"

It's enough to give a knight mares.

Every morning when I shave I get an itch to put a screwdriver to "Vili" and see what he's got inside. But I know — or rather, I'm afraid — that all I'll find is a thin square plate full of dots and dashes. A sort of plastic *matza*. (A perforated ceremonial cracker).

AND THEN last Monday good fortune placed me on a Jumbo right next to a middle-aged gentleman, who introduced himself during a magazine-swap as an electronics expert. I produced "Vili," who's always with me, and swooped upon my neighbour.

"Please explain how it works or I'll never sleep again."

The expert turned "Vili" over in his hands.

"It's quite simple," he said. "The computer translates every chess concept into a binary decimal fraction according to a logical diagram scripted into a basic transistor circuit which automatically sends impulses to the register's diodes."

I've always been for the manual system myself.

I accordingly twisted his arm a bit and said grimly:

"Leave the propaganda, Engineer! Me, I want the truth: how for the love of Mike can a *matza* know the Sicilian defense?"

The engineer said nothing and all the air went out of him with a hiss.

"I haven't a clue," he whispered at last. "I think nobody really understands it. Maybe the Japanese.

"Still," I prodded, "still, how do you explain a chess computer?"

"A miracle, sir, a plain miracle."

We knelt and prayed together. We were up aloft, don't forget, which is close. Personally I felt a lot better afterwards: a mystical experience I can take. A miracle makes sense. Only stop selling me *bobbe meises* (fairy tales) about registers, impulses, hey diddle diodes. I'm not a baby please.

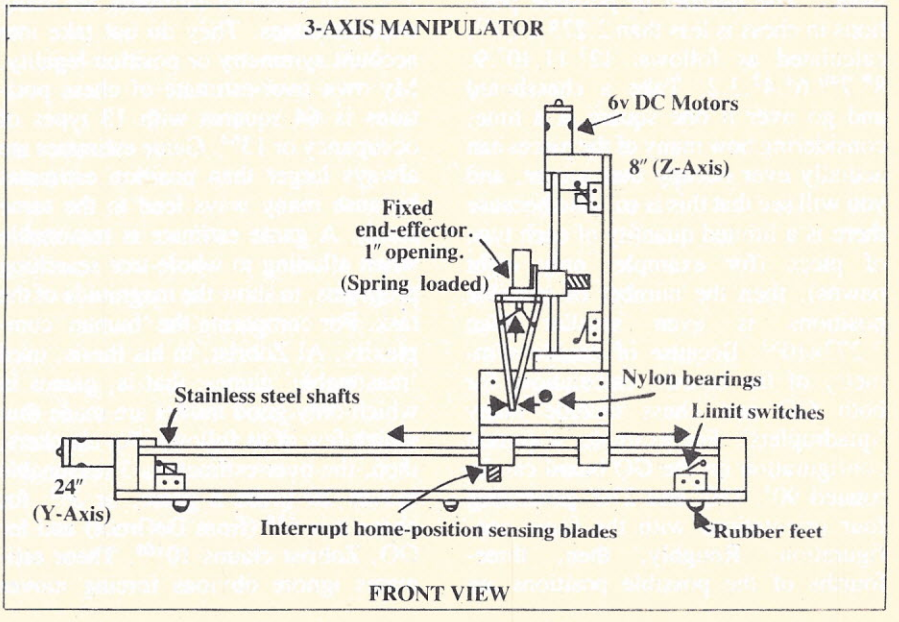
So, "Vili's" a miracle, just like that business with the Maccabees when the oil lasted through a week-long embargo. My "Vili" is only a miracle, and his rooks can go sit on a tree.

Ever since that explanation in the sky I've stopped investigating. They didn't take Bobby Fischer apart to see what was inside either. Now I think I'll buy me a second chess computer and realize an old dream of mine: let the two play against each other, and then I'll be free at last to go and see my wife and children at her daddy's.

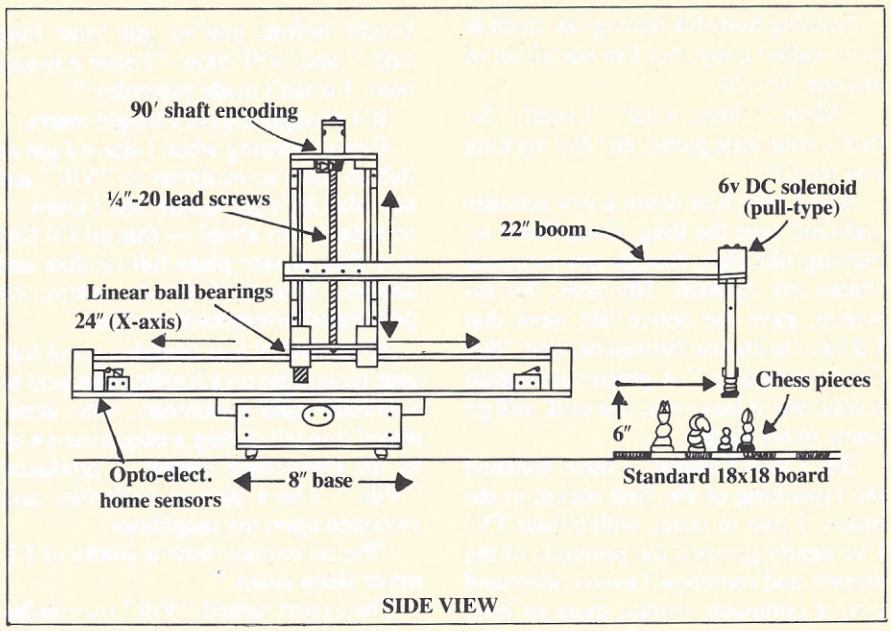
Translated by Miriam Arad. By arrangement with "Maariv."

Prime Mover

. . .A device that can be controlled by a computer to pick up and move chess pieces was shown by Gallaher Research company at the NCC show in New York in June. The mechanism can, at the option of the user, be connected to a computer, and, with proper interfacing, make responsive moves in a chess game in compliance with decisions from a computer chess program. The "3-axis robot manipulator" (see diagram) is sold by the company without a chess program. Specifications of this 3-axis "chess mover" include: 18" X-axis travel; 18" Z-axis travel; 6" Y-axis travel; 10 in/sec transverse speed; no close-in speed; solenoid end effector; 1" grasp; ball-bearing carriages; 8 oz. pay load (maximum) and 1 mm. accuracy. At the show, Dan Peterson, of Cincinatti, associated with Gallaher



Research, described the chess manipulator and ran a video tape showing the device in action. The kit, he explained, includes controls and interfaces electronics and can be connected to any computer, large or small, through TTL lines. The power supply operates from a 117 VAC, 60 Hz input. The instruction manual contains flowcharts and all application information. But a chess program for the "manipulator" is not available, as the company feels this is the concern of the individual chess programmer. Dan's final comment indicated that the manipulator kit could be easily modified to handle other game-piece dimensions (backgammon, checkers, etc.) Further information on this robotic arm can be obtained from Gallaher Research Inc., PO Box 10767, Salem Station, Winston-Salem, NC 27108.



SIDE VIEW

Complexity of Games

. . .A previous issue of PERSONAL COMPUTING mentioned 10^{120} as being the huge number of possible "positions" in chess and 10^{761} as the colossal number of possible "positions" in GO. A letter from Gordon D. Kirchhevel, of 625 W. Deming Place, Chicago, disagrees with those numbers. "The possible positions in GO is not 10^{761}," he writes, "but 3^{361}, because there are 361 points on a GO board with three possibilities for each point (black stone, white stone, no stone). The number of possible positions in chess is less than 2.273×10^{53}, calculated as follows: $12^3.11.10^2.9.8^8.7^{40}.6^4.4^2.3.2$. Take a chessboard and go over it one square at a time, considering how many of the pieces can actually ever occupy that square, and you will see that this is so. And because there is a limited quantity of each type of piece (for example, only eight pawns), then the number of possible positions is even smaller than 2.273×10^{53}. Because of double symmetry of the boards, calculations for both GO and chess include many 'quadruplets'. For example, a certain configuration on the GO board can be rotated 90°, 180° and 270° generating four orientations with the same configuration. Roughly, then, three-fourths of the possible positions are quadruplets. So, for all practical purposes there are only about 4.352×10^{171} truly different configurations possible on the GO board."

Bruce Wilcox of the University of Michigan, co-author of the game-playing Reitman-Wilcox GO program, agrees with Kirchhevel: "The trouble is not with the statistics, but with the mislabeling," says Wilcox. "The number 10^{171} refers not to positions but to games or 'paths down the move tree'. Gordon is correct in his calculation of 3^{361}. All standard estimates are really over-estimates. They do not take into account symmetry or position legality. My own over-estimate of chess positions is 64 squares with 13 types of occupancy or 13^{64}. Game estimates are always larger than position estimates because many ways lead to the same result. A game estimate is reasonable when alluding to whole-tree searching programs, to show the magnitude of the task. For comparing the 'human' complexity, Al Zobrist, in his thesis, used 'reasonable' games; that is, games in which only good moves are made (but which few of us follow). For checkers, then, the over-estimate is 3 reasonable moves 20 times a game, or 3^{20}; for chess it is 5^{50} (from DeGroot) and for GO, Zobrist claims 10^{100}. These estimates ignore obvious forcing moves which hardly count as 'free will' and add nothing to the complexity if you see them. The basis for 'position estimates' is always the number of choices for occupancy per square to the number of squares power (minus illegalities and symmetrical placement). The basis for 'game estimates' is the number of legal first moves, times the number of legal second moves, etc."

Thomas Throop, author of Computer Bridge in PERSONAL COMPUTING, suggests that differences between "games" and "positions" are similar to traveling experiences. "One person driving from New York to Chicago and another driving from New York to Miami," observes Tom, "arrive at their separate destinations according to their respective routes and schedules. The sequence of 'moves' each made represents the concept of 'games'. Their 'moves' involve such things as the specific roads followed, gas line stops, accidents encountered and the speed of driving. The destinations reached correspond to 'positions' in games, which can be achieved by many different move sequences. These different move sequences, or 'game possibilities' are, then, a better representation of difficulty than are 'position possibilities'. Thus, Al Zobrist is on the right track. However, the greater length

of a game does not make it more complex. The real difficulty of the game involves the average number of move possibilities (total moves or just reasonable-looking moves, as you wish) and the number of moves a player will plan ahead (which is not usually to the end of the game). A given skill level will require planning ahead a different number of moves for different games. What the number of moves are for different games is an interesting question. However, to play expert chess (by some objective criterion), for example, requires each player to plan ahead an average of 8 moves while considering seriously only ten choices (Zobrist's number) at each move. Then, the meaningful 'measure of complexity' at the expert level is, for chess, 10^{16}."

Prof. I.J. Good, of Virginia Polytechnic Institute and State University at Blacksburg, VA discussed this subject in his article "A Five-Year Plan For Automatic Chess" in MACHINE INTELLIGENCE II (edited by Dale and Michie, published in 1968 by Oliver and Boyd). "Consider the number of possible games of chess," wrote Prof. Good. "If 50 moves are played on each side without any captures or pawn moves, then in some sets of rules, the game is drawn, whereas, in other sets, the draw must be claimed. If the rule is taken as mandatory, then no game can last more than 6000 moves on each side. Also, in any position, even if all the pawns have been promoted to Queenhood, the number of possible moves cannot exceed 321. Therefore, the number of possible games is less than $321^{12000} < 10^{30000}$. If we restrict our attention to *reasonable* games we get a much lower estimate.

"Consider, also, the number of possible chess **positions.** In earlier works, I have already calculated that the number of positions, in which no pawn has been promoted and there are no doubled pawns, is less than $2x10^{39}$. The number of positions in which no capture has occurred is about 10^{32}. Allowing for all possibilities the number is less than $2x10^{50}$. (A master chess player would be happy if he knew what the best move was in 99.9% of the positions with nearly level material, weighted with their probabilities of occurring, that would occur in master chess, without blunders. And the number of such positions may be less than 10^{24}, judging by some other calculations)."

At Wit's End

. . .A letter from Bruce W. Cheney, 1606 Eastus St., Dallas, TX 75208, raises an amusing point. "After reading Morris Miller's review of David Levy's three chess books in the June issue," writes Bruce, "my faith in the credibility of anything Morris may have to say has been destroyed. Not only has he neglected to do his research, but I suspect that his sense of humor will also be found deficient. In his review he referred to a statement made in a particular issue of Scientific American which claimed that a computer had, in effect, 'solved' chess openings with the move 1. P-KR4. Morris's comment was 'One need not be a master or even a strong player to realize that Scientific American has been hoaxed or the computer improperly programmed.'

"Indeed, one need only be of minimal mental stature and marginally aware of the world around oneself to realize that the APRIL issue of any western magazine is liable to contain humorous and fantastic articles and statements. Martin Gardner in his April 1975 Scientific American column on mathematical games gave us an even better clue by naming the computer in question 'MacHic' (sic), not to mention the report of an offer to Bobby Fischer for $25 million dollars to play the machine. The five other subjects of the article included a very amusing sketch of Leonardo Da Vinci inventing the flush toilet. I suggest you replace Mr. Miller with someone of a higher caliber, at least a 45. Get that one, Morris? No? Well, I have this bridge I'd like to show you. . ."

Morris' reply to his accuser:

"Upon rereading Levy's 'Computer Chess', I agree with Bruce Cheney that my sense of seriousness was uppermost and my sense of humor dormant when I read the last part of the book. The internal language Levy used should have warned me he was indulging in deadpan humor. All I can say is that when reading a book for review, one's normal sense of the ridiculous undergoes a sea change. But I am in good company. If you look at Mark Twain's 'Roughing It' he recounts an instance when as a newspaper reporter he perpetrated a gorgeous hoax in print which was picked up and widely reprinted in all seriousness. Western humor, you see, can take in westerners as well as easterners."

TI joins the chess club

. . .At NCC '79, David Levy announced that working with the Texas Instruments company he had written for them a new chess program. Some of the interesting features in the TI unit, not yet available in other devices are, according to Levy, the ability of TI to play simultaneous chess. The unit will be able to play as many as 9 different players at one time. Also, the new program, according to Levy, has three levels of play; "good" for good players; "normal" for Class C or lower; and a new "worse" level. This latter level is designed to give the player confidence in his battle against the computer. No matter how poorly the player does, he cannot lose. In fact if he should blunder into a position where the computer will be able to mate him at the next move, the program simply resigns, allowing the human to win and maintain his self-esteem. "Just watch for it," exclaims David Levy who is very enthusiastic about his new TI program.

On sacrificing

..."Since Morris Miller mentions the famous positional sacrifice by CHAOS in the first World Computer Chess Championship," writes Ronald Wilcox, of 400 Second Ave., New York, "I would like to add a few notes. Another example of a sound positional piece sacrifice that I am aware of is the one made by Chess 4.7 in the first game of the match with David Levy. Both examples involved the sacrifice for 1 pawn. Actually the Knight for 2 pawns positional sacrifice is not that rare in Computer Chess. In round 1 of the third U.S. Computer Chess Championship (1972) SCHACH exchanged a Knight for 2 center pawns against TECH. The move was clearly an unsound positional sacrifice. In his comments on the sacrifice by SCHACH, Monroe New-

born suggests that this is not an unusual exchange for a computer program and is possibly due to the positional value obtained by removing 2 of the opponent's center pawns. The exchange reflects a weakness in the evaluation function. This is one reason why most programs limit the weighting of positional factors in the evaluation function so that they do not exceed the value of a pawn. A piece 'sacrifice' by a computer may be motivated by a variety of factors. It may represent a horizon effect, an improperly tuned evaluation function, a deep winning combination, or, and probably least likely, a true positional sacrifice. Since a print-out of the main continuations found during the search is not usually available, the proper understanding of the move requires knowledge of the program logic and the search parameters. Judging the move according to the actual follow-up of moves during the game can be quite misleading."

Morris Miller offers some comments concerning this opinion of positional sacrifice: "Positional sacrifices give some insight into how a program works.

"The usual positional sacrifices I have seen in the course of some computer games I would say are sound ones. I suppose there have been some unsound ones also. This suggests that deriving evaluation function is difficult and complex. Sacrificing a piece for two pawns, or some such combination, is difficult to judge. In the future I will have to try to determine if the horizon effect enters into a program's play, when annotating a game, if I can. My annotations on computer chess are meant to be useful. Hopefully, the comments might help programmers improve the performance of their programs by applying an objective (human oriented) rationale. While the horizon effect enters into consideration, the problem solving of the program is done and judged by the human level of performance, which I believe is the ultimate yardstick. Nevertheless, it is important to be aware of factors such as horizon effect which play a role, since it is only in that way that programs can be improved. The limitation isn't critical, but it helps when charting a proper course on the chessboard."

BORIS Visits the Winery

The Chafitz product, BORIS, (not the new version) participated in the last Paul Masson Tournament in California and chalked up a formidable record: 3 games won, 1 tied and only 1 lost to gain a high position in the Class B rankings there.

New Chess Machine

Master Distributors has introduced a new pocket-sized chess game called CHESS MASTER. The company, a division of Promedic, Mfg., Inc., describes its product as being "an exciting chess game programmed to present a wide range of selective *problems* that will challenge and teach any individual the finer points of chess." The unit is available from Master Distributors at a current price of $49.50. More information can be obtained by writing to the company at The Solar Building, 1000 16th St., NW, Washington, DC 20036. "Chess is one of the most pleasurable ways of exercising a person's thinking ability and this convenient new unit will give you endless hours of challenging enjoyment," proclaims the company. (The company could have added that computer-assisted chess lurks on the immediate horizon. Man and his computer opposite an antagonist who also is consulting a computer is an exciting concept.)

MASTERCHESS is a pocket-sized device that contains 1000 challenging problems (plus correct solutions.)

COMPUTER GAMES OF OTHER SORTS

("Intelligent" Computer games welcomed by this department. Address all correspondence to COMPUTER GAMES DEPARTMENT, Personal Computing.)

The GOMOKU Tournament

Of all the "intelligent" games being played on the computer today, chess is clearly the most popular. In second place, and climbing steadily is the game of GOMOKU. The most popular North American GOMOKU tournament is currently being run in Canada by Professor Shein Wang of Guelph University's Institute of Computer Science. The tournament has been sizzling since 1975 and it grows more popular every year. The outstanding attraction to GOMOKU is the ease with which it can be programmed, using any kind of computer and any language. It is a non-trivial, simply stated game for which a guaranteed winning strategy has not been found. Programs in GOMOKU may, like chess, profitably use book moves, look ahead and pattern recognition. In terms of complexity, however, GOMOKU is considered to be far below chess, but above checkers.

"GOMOKU is basically a game of Tic-Tac-Toe," explains Prof. Wang. "It is played on a 19 × 19 board similar to the GO board. Object of the game is simply to place five men in a row: vertically, horizontally or diagonally. First player to get five-in-a-row wins.

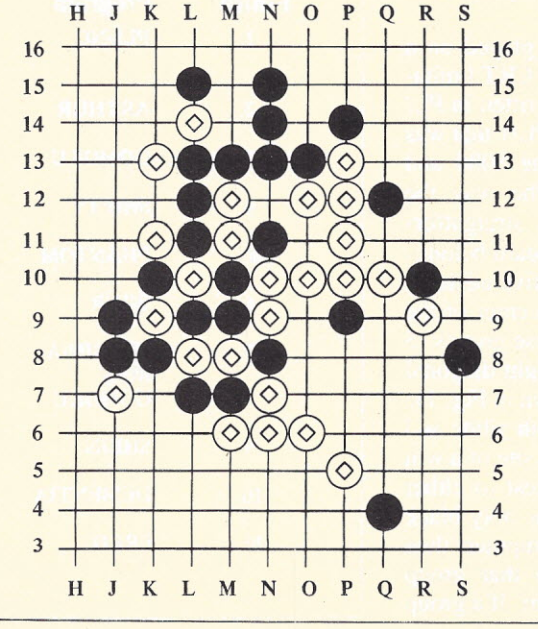
"GOMOKU's history goes back more than 2000 years. Currently it is very popular in China and Japan. Children there play it fervently. They use either a paper and pencil and draw x's and o's; or they may use an official GO board with black and white stones. As in the game of GO, black stones always move first. Usually a player's first move is around the center of the board, perferably at the K-0 position. Logic for this is that a stone placed near the center can be developed in all directions; but if it is positioned near the edge it has fewer paths to follow. The white-stone player is considered the 'defender' because he is a move behind. Strategy is aimed at blocking the opponent's pattern for a few moves. It is dangerous for defending white to stay away from the black stones. If he puts his move at a distance from the other side, black can concentrate on the area where he already is ahead and produce a two-man advantage which usually leads to a quick win.

"The attacking side always has the advantage because he possesses the initiative and has a better chance to set the stage for a winning game.

"Computer GOMOKU programs have been written in PL/1, FORTRAN, Assembly, BASIC, ALGOL and APL. Some programs have been run on microcomputers. The micro programs rely heavily on good heuristics to lead them. However, their inability to look ahead very far puts them at a severe disadvantage when they face an opposing program that can look ahead ten moves or more. A program that placed in the 1977 tournament, by the way, was run on a Microdata 8080 and did quite well, beating out some big computers. But programs improve with age, and micro programs probably face some tough challenges to keep up with the others. But, as the size of memory chips go up, the micro programs will become more competitive. In fact, I hope to put my own program on a micro one of these days to see how it will do.

"Our current North American GOMOKU champion is a PL/1 program written by Michael Compton of Ottawa, Ontario. He has been beaten for the world title by a European program but I personally don't think the European program is that good. You see, the opening is very important but hard to program and Michael lost because he ran into a few wicked opening combinations which were not familiar to his program."

Writing in the SIGART Newsletter of April 1977, Lawrence J. Mazlack, also of the University of Guelph, described the 1976 second computer GOMOKU tournament. "Eleven programs competed (up from four last year)," he wrote. "And the programs all played at a considerably higher level than last year. The struggle for the championship finally worked down to a confrontation between "PLUNC" (written by Ed Johnson and A. Coston, both of Chapel Hill, NC) and "ARTHUR" (written by M. Compton of Ottawa, Ontario). The game and final board position of this encounter follows:



GOMOKU Diagram

Black: Johnson & Coston (Moves First)
White: M Compton

Position after 51st move when White resigns.

Black: Johnson & Coston (moves first)
White: M. Compton

"The moves of the game were: 1. L-11; 2. M-11; 3. M-10; 4. N-9; 5. L-9; 6. N-10; 7. L-12; 8. L-8; 9. N-11; 10. O-12; 11. L-13; 12. L-10; 13. L-15; 14. L-14; 15. M-9; 16. O-10; 17. O-13; 18. M-8; 19. K-8; 20. J-7; 21. L-7; 22. K-9; 23. J-8; 24. N-6; 25. M-7; 26. N-7; 27. N-8; 28. P-11; 29. Q-12; 30. Q-10; 31. N-13; 32. R-9; 33. S-8; 34. P-13; 35. P-9; 36. O-6; 37. J-9; 38. P-10; 39. R-10; 40. P-5; 41. Q-4; 42. M-6; 43. M-13; 44. K-13; 45. N-14; 46. P-12; 47. P-14; 48. K-11; 49. K-10; 50. M-12; 51. N-15"

Commentary by Lawrence Mazlack

"1) ARTHUR's L-8 at Move 8 was a mistake and would have led to a quick defeat if PLUNC had not turned defensive at Move 15.
2) A better sequence from Move 8 was probably 8. L-10; 9. N-11; 10. O-12; 11. K-9; 12. M-9; 13. N-8.
3) A better black sequence at Move 15 was probably 15. K-14 . . . 17. J-13 . . . 19. K-13 . . . 21. L-12.
4) At Move 26 white was trying for the win: 26. N-7 . . . 28. P-11 . . . 30. Q-10 . . . 32. P-10 . . . 34. P-9. Unfortunately this sequence does not win as a block at N-13 forms a three. There was a larger true winning sequence which ARTHUR overlooked of 26. N-8 . . . 28. P-8 . . . 30. P-11 . . . 32. O-9 . . . 34. P-10 . . . 36. Q-9.
5) After Move 37. J-9, ARTHUR has no defense, but J-9 was not the best move here. A better black sequence was probably 37. M-12 . . . 39. K-12 . . . 41. H-10.
6) ARTHUR resigned after Move 51 because it was forced to reply to the four with N-12; then O-15 would give its opponent a four and three leading to an unblockable win for PLUNC."

Jerry Crouch of the University of Rhode Island's Electrical Engineering Department is an active participant in the GOMOKU tournament. His following comments on GOMOKU and the tournament itself reveals the growing interest in that activity.

"If you have read recent newsletters on GOMOKU (issued by Shein Wang) you may have noticed a lot of changes in tournament rules. The original GOMOKU tournament was a round-robin in which everybody played everybody twice. But because moves in tournament games are relayed orally by long-distance telephone, the round-robin format was quite expensive. My own telephone expenses in 1977 were $170. Prof. Wang is currently trying to set up a more streamlined system that will be fair to everyone.

"My original program played on a 16 × 16 board because of CRT limitations. The program was written in PL/M, a language similar to PL/1 that was developed by Intel for the 8080 and 8008 microprocessors. The way the program works is quite straightforward. Each space on the board belongs to a number of groups of five adjacent spaces. A space near the center of the board belongs to 20 of these groups (5 horizontal, 5 vertical, 5 right diagonal and 5 left diagonal as shown in Fig. 1).

"If a group contains both white and black stones it cannot be a site of a win or loss and is of no interest to either player. If a group contains only black stones (let black be the computer) then adding a black stone to that group moves black closer to a win. If a group contains only white stones, then adding a black stone eliminates that group as a winning site for white and, consequently, diminishes white's chance of winning. Moving a black stone into an empty group also eliminates that group as a winning site for white and lays the groundwork for future expansion by black.

"What my program does is count the number of each type of groups that each cell belongs to (groups with no stones, groups with one black stone, groups with one white stone, etc.). My evaluation consists of multiplying the number of each group type by a weighting factor (selected by the programmer), summing these products and then setting the score of the cell to that value. After doing this for the entire board, the program then selects an empty cell with the highest score and moves there.

"In the example shown in Figure 2, the empty cell marked 'X' is part of one empty horizontal group; one empty vertical group; five empty right-diagonal groups; one empty left-diagonal group; two groups with 1 black stone; three groups with 2 black stones; one group with 1 white stone; one group with 2 white stones, and two groups with 3 white stones. I use the

The Final Standings after the 1976 second Gomoku Tournament were;

Finish	Program	Programmers	Computer
1.	PLUNC	E. Johnson A. Coston Chapel Hill, NC	PDP 11/45
2.	ARTHUR	M. Compton Montreal, Quebec	IBM 370/158
3.	GOMOKU	D. Walden Skokie, IL	Xerox 530
4.	SHIFTY	J. Day Cupertino, CA	IBM 370/155
4.	PHANTOM	T. Heaven London, Ontario	PDP 10
6.	WINR	M. Ouye Acamp, CA	Microdata 1800
7.	FIVE-IN-A-ROW	H. Baird Princeton, NJ	PDP 8
7.	GOMOKU	H. Saal Palo Alto, CA	IBM 370/158
9.	SHEIN	S. Wang Guelph, Ontario	IBM 370/155
10.	DEMENTIA	P. Fleischer Guelph, Ontario	IBM 370/155
11.	FRED	J. Sturdy Toronto, Ontario	IBM 370/155

arbitrary weighting factor shown in the value table of Figure 3.

Then the score of cell 'X' (multiplying the above 'usable' groups by weighting factor) is:

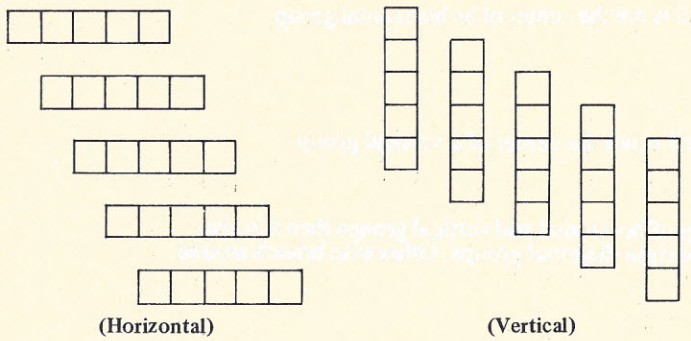
8×1 (empty)
$+ 2 \times 2$ (1 black stone)
$+ 3 \times 10$ (2 black stones)
$+ 1 \times 2$ (1 white stone)
$+ 1 \times 10$ (2 white stones)
$+ 2 \times 4$ (3 white stones)

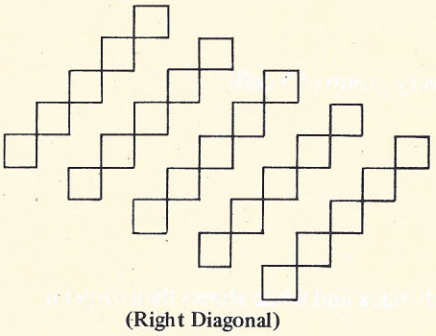
"Clearly the weight for a group with 4 black stones should be very large because that move is an instant win. The weight for 4 white stones should also be large but not quite as large as black's value. Best values for other types of groups are not so obvious.

"I never intended this program to work well. It was the third PL/M program I ever wrote and I wanted to see if my IMSAI would execute it at reasonable speeds. However, I was startled at the quality of play of such a simple program. My contest program for the tournament is based on the same technique but includes another routine to recognize certain forced-win or forced-loss situations. The original program would also claim a win with more than 5 stones in a row. That was changed by noting that a stone beyond the end of a group eliminates that group as a possible winning site for that player.

"The BASIC program shown here implements this same technique. It is written in very basic BASIC, and should run on most machines. It doesn't include any fancy cursor-control or formatted output because those functions are machine dependent. Unfortunately this BASIC program runs slowly on my IMSAI; unlike the PL/M version which moves in about 1.5 seconds. It would be interesting to implement the BASIC program on a faster machine such as the Z-80 or the 6502. Someone with saintly patience could even try to implement it in machine language. Right now my own PL/M program is frozen because I can't get access to a PL/M compiler. I hope to be able to eventually add look-ahead. I think it would be quite a nice feat to blow away all those folks running their programs on IBM heavy iron."

(Note: Readers interested in writing a GOMOKU program and perhaps joining the continuing North American tournament are urged to write to Dr. Shein Wang; Department of Computer Science; University of Guelph; Guelph, Ontario, Canada.)





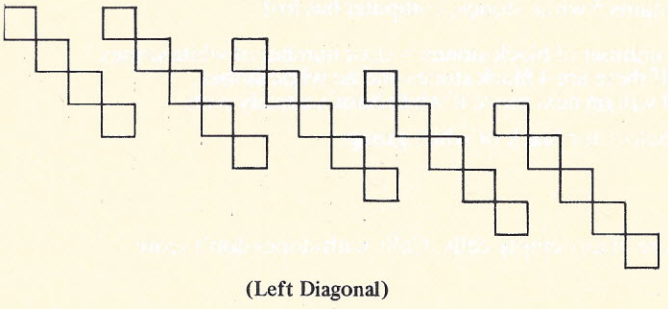


Figure 1

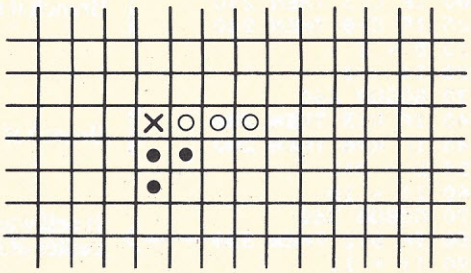


Figure 2

Value Table Weighting factors	Weighting Factors	
Number of Stones in Group Containing Empty Cell "X"	If Black Stone	If White Stone
0	1	1
1	2	2
2	10	10
3	50	40
4	1000	500

Figure 3

Gomoku in BASIC

Variables:	**B**	**Board. First 10 entries are row, second 10 entries are second row, etc. 0 = Empty. 1 = White (human) stone. 2 = Black (computer) stone.**
	V	**Score of each board position.**
	R, C	**Row and column for moves.**
	I1	**Increment for subsequent calls in a group. 1 = Horizontal. 10 = Vertical. 9 = Right diagonal. 11 = Left diagonal.**
	N(1)	**Number of empty stones in group.**
	N(2)	**Number of white stones in group.**
	N(3)	**Number of black stones in group.**
	F	**Weighting factor for white group.**
	G	**Weighting factor for black groups.**

Note: This program considers 5 *or more* stones in a row to be a win.

```
10 DIM B(100),N(3),V(100),F(5),G(5)
15 GOSUB 800
20 FOR I = 1 TO 100
30 B(I) = 0
40 NEXT I
50 PRINT "ENTER 1 TO MOVE FIRST, 0 OTHERWISE."
60 INPUT M
70 IF M = 0 THEN 130
80 PRINT "YOUR MOVE."
90 INPUT R,C                    Move is row, column.
100 T = (R-1)*10 + C
110 IF B(T) <> 0 THEN 80        <- Prevents illegal move.
120 B(T) = 1
130 FOR I = 1 TO 100            Clear scores.
140 V(I) = 0
150 NEXT I
160 V(55) = 1                   <- Bias this score to force initial move near center of board.
165 FOR R = 1 TO 10
170 FOR C = 1 TO 10
180 D=0
190 I = (R-1)*10 + C
200 IF C<3 THEN 240             Branch if this cell is not the center of an horizontal group.
205 IF C>8 THEN 240
210 D = 1
220 I1 = 1
230 GOSUB 360
240 IF R<3 THEN 280             Branch if this cell is not the center of a vertical group.
245 IF R>8 THEN 280
250 D = D+1
260 I1 = 10
270 GOSUB 360
280 IF D<2 THEN 330             -> If cell was center of horizontal and vertical groups then it is also
290 I1 = 11                        center of left and right diagonal groups. Otherwise branch around.
300 GOSUB 360
310 I2 = 9
320 GOSUB 360
330 NEXT C
340 NEXT R
350 GO TO 620
360 FOR J = 1 TO 3              <- This code executed for very group of 5 cells.
370 N(J) = 0                    Initialize stone count.
380 NEXT J
390 FOR J = -2 TO 2             Count stones.
400 K = B(I+J*I1) + 1
410 N(K) = N(K) + 1
420 NEXT J
430 IF N(2) = 0 THEN 450
435 IF N(3) = 0 THEN 450
440 RETURN                      <- If this group contains both black and white stones then forget it.
450 IF N(2) < 5 THEN 480        If this group contains 5 white stones, computer has lost.
460 PRINT "YOU WIN."
470 STOP
480 IF N(3) <> 4 THEN 500       <- If we get here number of black stones = 0; or number of white stones
490 B1 = 1                         = 0; or both. If there are 4 black stones and no white stones,
500 IF N(2) <> 0 THEN 530          computer will win on next move if white hasn't already won.
510 E = G(N(3)+1)               Set weighting factors for black or white group.
520 GO TO 540
530 E = F(N(2)+1)
540 FOR J = -2 TO 2             Increment score of any empty cells. Cells with stones don't score.
550 T = I + J*I1
555 IF B(T) <> 0 THEN 570
560 V(T) = V(T) + E
570 NEXT J
580 RETURN
```

Program Listing continued

```
620 I1 = 1
630 V1 = V(1)
640 FOR J = 2 TO 100
650 IF V1 > V(J) THEN 680
660 I1 = J
670 V1 = V(J)
680 NEXT J
690 IF V1 >= 4 THEN 720
700 PRINT "GAME IS DRAWN"
710 STOP
720 B(I1) = 2
730 R = INT((I1 - 1)/10) + 1
740 C = I1 - 10*(R-1)
750 PRINT "MY MOVE IS";R,C
760 IF B1 = 0 THEN 80
770 PRINT "I WIN."
780 STOP
800 F(1) = 4
810 F(2) = 12
820 F(3) = 30
830 F(4) = 90
840 F(5) = 10000
850 G(1) = 4
860 G(2) = 12
870 G(3) = 30
880 G(4) = 100
890 G(5) = 100000
900 RETURN
999 END
```

Pick largest score.

If largest score is smaller than smallest weighting factor, then there are no groups without both black and white stones.

Make move.

If no win then loop.

Set weighting factors.

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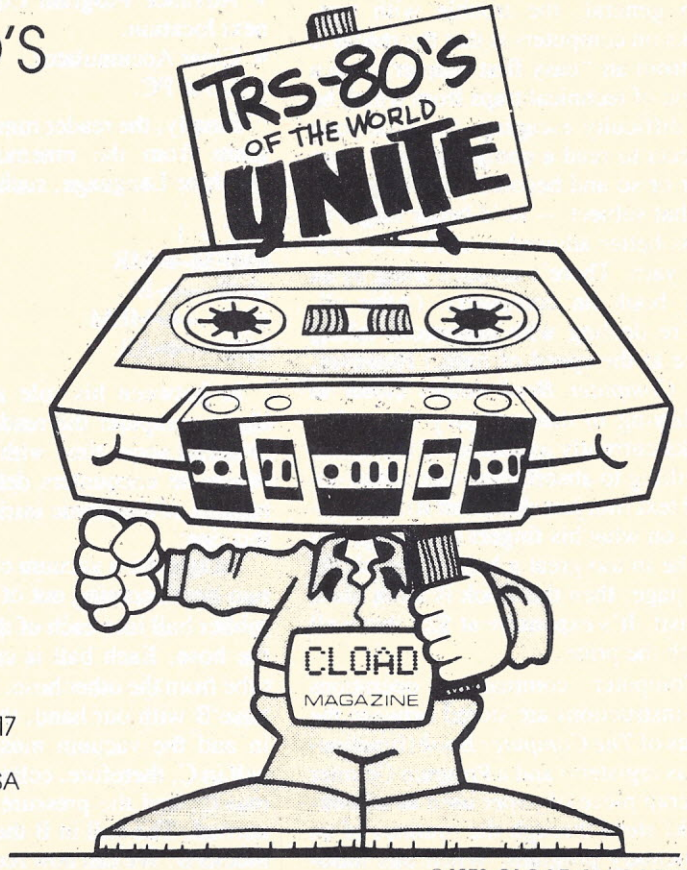

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CIRCLE 22

"How to Become a Computer in One Easy Book"

The Computer Book, by Fred Lee. Artech House, 610 Washington St., Dedham, MA 02026; 365 pp; $22. Vellum cover.

There is a literary axiom which states that if you write a book where the reader can hardly wait to turn the page to see what next is going to happen, then you've written a hit book. On that premise, then, *The Computer Book* should be an instant best seller. The readers of this book no sooner turn the front cover than they're off and running — flipping pages like mad. The reason for the hectic activity, a highly unusual response in the world of literature, is that author Fred Lee transforms the reader into a human computer. On the very first page of the text, Fred performs his act of metamorphosis and starts the reader (now computer) off on a canter through every step of a simple program.

In general, the trouble with textbooks on computers is that the reader is led from an "easy first chapter" into a jungle of technical traps from which he has difficulty escaping. So, if anyone expects to read a computer book in an hour or so and become knowledgeable on that subject — he'd better forget it. He is better advised to stick to a mystery yarn. There's no such thing as an easy book on computers. (After all, you're dealing with operations taking place at the speed of light.) However, *The Computer Book* comes closer to qualifying in that category than other books currently available. If the reader is willing to absorb Fred Lee's easy-to-read text (not just skim over it), concentrate on what his fingers are doing, and not be in too great a hurry to reach the last page, then this book is a fun place to visit. It's expensive at $22, but well worth the price.

Computer commands, operations and instructions are stored between the pages of *The Computer Book* (functioning as registers) and a Program Counter (a scrap piece of paper used as a bookmark) steps through the routines of an elementary program. When this introductory program is finished (about a half hour) the human computer winds up with muscle-cramped fingers and a spinning head; but he should now know how the computer actually functions. And, in the exercise, he learns what happens in response to such commands as READ, STORE, CLEAR, ADD, JUMP, WRITE, SHIFT and HALT. A typical instruction look like this:

WRITE
- Move bookmark to next location.
- Write the number from Accumulator into space X on a piece of paper.
- Put 0 into Accumulator (sheet of paper).
- Go to bookmark.

After the reader has gone through some of the text and has been instructed on what the computer is all about, Fred then sends him off through another, more complicated program. This time the instructions become a little more technical, as:

- Advance Program Counter (PC) to next location.
- Clear Accumulator.
- Go to PC.

Finally, the reader runs the same program from the mnemonic codes in Machine Language, such as:

- PC + 1
- MEM → MR
- MR → IR
- MR → MEM
- PC → AR

In between his role as functioning like a computer the reader is expected to spend some time with the text itself where he encounters delightful explanations of electronic intricacies such as this one:

"Consider a vacuum cleaner that has two hoses coming out of it. We stick a rubber ball into each of the two ends of the hose. Each ball is controlled by a tube from the other hose. If we cover up hose B with our hand, the air can't get in and the vacuum must appear. The ball in C, therefore, collapses, air flows into C, and the pressure there goes to normal. The ball in B then inflates and blocks B. We can now remove our hand from the tube — but nothing changes. Hose B is blocked by the ball. Now, cover the C opening. The vacuum in C rises, collapsing the ball in B. Air is allowed in and pressure returns to normal. The ball in C inflates and blocks C even if we removed our hand. The gadget has 'flipped.' If we now cover B again, the gadget 'flops' over to the first condition and so on. This is a 'flip flop.' Notice that this device has memory. It is put into one state or another by the action of the hand and stays in that state after the action is gone. It 'remembers' or 'stores' the fact that the action occurred."

Author Lee goes on to show how substitution of electric current for vacuum cleaner creates transistors, gates and electronic circuits. He uses the method of simple analogies to explain other complex electronic functions.

Although, as the author states, this book can be used as a textbook (excellent for beginners at any level), it was intended as a self-study book for anyone with an interest in computing. It is an irony that most owners of microcomputers don't even know what a chip looks like. Latest estimates suggest that there are about 400,000 microcomputers in use today and 80% of them are run by cassette or disk interfacing. The operator of the computer sits at the keyboard and responds to the prompting that appears on the CRT. He hasn't the faintest notion of what is actually going on. This book, then, is for people like him — as well as for people who find computers a complex subject (which it is).

If any reader gets through this book without acquiring a good understanding of the computer's functions, it's only because he really doesn't know how to flip pages properly.

Other subjects that receive Fred Lee's delightful treatment are Codes, Binary Math, Circuits, Memories, Peripherals, Programming, Practice Programs, Assembly Language, Fortran, Cobol, etc., plus quizzes, pen-and-ink sketches, tables

and lots of action. As a sample of the contents, see the accompanying reprint of his Assembly Language chapter.

At various places throughout the book the author shakes a warning finger at his reader by including a marginal note such as "Read this part five times!" Shows how concerned he is that the readers get something out of this book, and shows also, what an excellent presentation of a difficult subject Fred has constructed.

—Reviewed by Harry Shershow

Assembly Language

What we have done so far in our programming has been to write sequences of codes and instructions for the computer. We have written them in exactly the form in which we put them into the computer memory. We may have substituted octal numbers for 1's and 0's, but that's just another way of writing 1's and 0's. We have programmed in the *language of the machine*.

As we now know from our experience, there are two main jobs to do in writing our programs in *machine language*. One is deciding what instructions to use and in what order. The other is converting the instructions to codes that the machine can understand and assigning them memory locations. The first job involves ingenuity, creativity, even artistry. The second is more or less routine. It involves looking up codes, figuring out addresses, keeping track of memory locations, etc. It is tedious, dull, and, in long programs, very tricky and time-consuming. Worst of all, each time a change is made that adds just one memory location in the middle of a program, the entire coding job has to be done all over again. It is, in other words, exactly the kind of job a computer does best. Why not write a computer program in machine language and put it into the computer? Design this program to read another program written not in machine language, but using perhaps the mnemonics we used in our program list, one that does exactly what we had to do to convert symbols to machine codes. As a matter of fact, that's exactly what is done. The programs that do the coding are called *assembly programs* or *assemblers*. The system of symbols in which these programs are written is called the *assembly language*.

Because each different computer has its own unique instruction set and coding scheme, each also must have a unique assembly language. Commercial computers come with assembly languages and assembly programs designed by their manufacturers.

Assembly languages are called languages because that's just what they are. Their purpose is to communicate to a computer what the programmer wants it to do. They have a vocabulary of words and symbols, and they have rules of grammar and punctuation that prescribe how the words and symbols must be arranged into statements. Because the computer is a simple-minded machine, the rules must be simple and unambiguous. These rules are called the *syntax* of the language.

To represent the information that is to be put into a particular memory location, the programmer must write a *statement* which, by sheer coincidence, looks very much like a line from our program list if we leave out the locations and octal codes. Some typical program statements look like this:

(Label)	(Instruction, Operand)	(Comments)
SPTS	ADD, I AXFT	;ADD OLD TOTAL
	STR, OPND	;STORE AGAIN
	ADI, +25	;ADD +25
	HLT	;END OF TEST

The vocabulary consists of the mnemonics assigned to the instructions, labels, and numbers. Rules of various assemblers concern things like the number of letters permissible in labels; combinations that aren't permitted; the way decimal, octal, positive, or negative numbers are expressed; etc. The grammar and punctuation rules spell out in what order the words and symbols must appear, and what spaces or punctuation symbols must separate them.

What the computer actually receives when such a program is read in under control of the assembler program is more like this:

S-P-T-S-Space-Space-A-D-D-comma-Space-I-
Space-A-X-F-T-Space-Space-Semicolon-Space-A-D-
1st line D-Space-----T-O-T-A-L-Carriage Return-
Line-Feed-Space-Space-Space-Space-Space-Space-S-T-R-
Comma-O-P-N-D-Space-Space-Space-Space-Semicolon-Space-
2nd line S-T-O-R-E-Space-A-G-A-I-N-Carriage Return-Line Feed . . . etc.

You can easily see how the assembler could be designed to distinguish between labels, instructions, addresses, etc. It does it on the basis of decisions like "Is the first character of a line a letter or a blank?", and "Does the code group start with a number?" A line is usually ended with two special characters — carriage return and line feed respectively, which mean to the computer, the end of a line and, to a teletypewriter, to go to the start of a new line.

The assembler is designed to recognize all of the mnemonics of the instruction set when they appear in the instruction column. In addition, the assembler also recognizes some code groups or symbols in the instruction column that are pseudo-instructions; that is, they are instructions for the assembler itself and not to be put into the program being assembled.

These pseudo-instructions or assembler-directives tell the assembler such things as where to start the program in memory, when the end of the program occurs, to skip so many locations and leave room for a table, to assign symbols to constants, and so on.

All assemblers can assign programs to fixed locations in memory specified by the programmer. These are called *absolute* programs. There are assemblers that can also generate *relocatable* programs. These programs are assigned memory locations beginning with location 0. The assignment of actual locations is deferred until the program is loaded into memory. The loading program then takes care of assigning actual memory locations.

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This feature lets the user wait until it is known what else is in memory before deciding where to put the program.

Comments and notes are also handled by the assembler. They have nothing at all to do with the assembly process. They are merely stored so that they can be printed out again when the assembled program is printed out. Since comments are preceded by some symbol that the assembler can recognize, one can use an entire line for notes or comments as long as the symbol (a semicolon, in our example) is first.

Example:

```
;TELETYPE DRIVER
;THIS ROUTINE IS TO BE USED
   WITH ASR33
;TELETYPE ONLY
;PART 1
 STRT, LCA (etc.)
;PREPARE ACCUMULATOR
```

Characters that control the paper feeding and spacing of the teletype can also be put into the program. These too are ignored during assembly, and played back when the program is printed out.

To use an assembler, then, you would do the following.

First, learn the rules of grammar and punctuation for the assembler you are going to use, along with the pseudo instructions. Write the program in just about the way you have already written some, leaving out actual locations and codes, and adding the necessary pseudo-instructions. The program is then typed on a teletypewriter with the paper tape punch turned on (or on a card punching machine). The main result is to produce a tape with the program on it in serial form — one character at a time. The characters are in the standard (ASCII) teletype code. This tape is called the *source tape*. The program, in this pre-assembled form, is the *source program*.

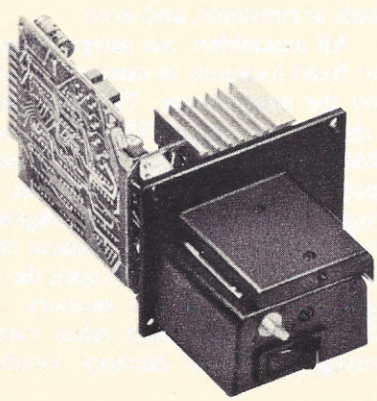
The next step is to load the assembler program into a computer (from a tape or other storage medium), or to find a computer with the assembler in memory. This computer must have a peripheral capable of reading the source tape (or cards). Set the computer to the starting location of the assembler, load the source tape into the tape reader (or cards into the card reader), and push the run button.

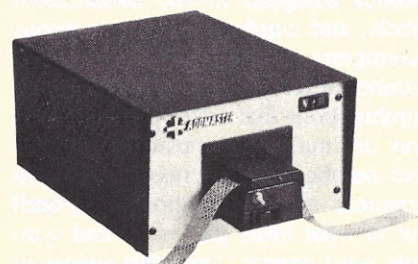
Many assemblers can't do the assembly with a single reading of the source program. They require two or three passes. On the first pass, the assembler picks outs all labels, assigns locations to them, and makes a symbol table. On the second pass it does the coding. A binary code is generated for each location of the program. At the same time, the teletype's paper tape punch can punch these codes onto a tape. This tape differs from the source tape in that it has on it the actual binary codes that are to be loaded into memory. This tape is called the *object tape*. It is this tape that loads the assembled program into a computer. Pass number three can be used to produce a printout of the assembled program. This printout looks very much like the program lists we made earlier except that the machine codes (in octal) are printed right after the memory locations. All titles and notes also appear on the printout, as does the symbol table. This printout is officially called the *program listing*.

While we're discussing assemblers, it is a good time to bring up the distinctions among hardware, software, firmware, and just plain programs:

- The term hardware applies to all of the physical things in the computer system — the circuits, cables, machines, etc.
- Software is what we call the programs designed by the computer maker and sold along with the computer. They are the programs that have to do with running the computer, as opposed to programs designed to solve the problems of whoever buys the computer. Software includes programs like loaders, peripheral drivers, teletype editing programs, "diagnostic" programs designed to detect troubles in the computer, assemblers, and compilers. These programs are usually supplied as individual tapes.
- Firmware is a relatively new term that has been given to programs that have been stored in Read-Only Memories (ROMs).Computers designed with ROM firmware have the advantage of having these programs resident in the computer. Other computers have to have them put into the working memory before they can be used.
- Just plain programs or application programs are the programs written usually by the users of the computer to solve a problem or do a job.

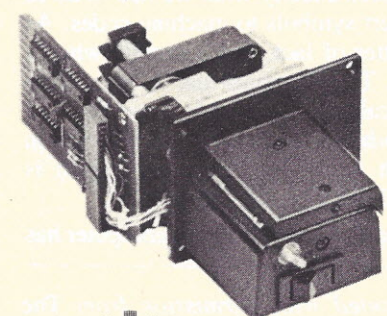
601 Reader
Stops on character
Stepper motor
Reads 150 characters/second





612 Stand Alone Reader
Same features as 601
. . . plus . . .
Parallel TTL Level or
RS-232C or TTY configurations

640 Data Loader
Low cost
Reads 350 characters/second



ADDMASTER CORPORATION
416 Junipero Serra Drive San Gabriel, California 91776

CIRCLE 26

BASIC-1P

Now you can run all your Level I programs on your Level II TRS-80 – without troublesome conversion.

BY WILLIAM L. COLSHER

Upgrading your TRS-80 to Level II does not have to mean you loose access to your accumulated library of Level I programs. BASIC-1P turns your 16K Level II TRS-80 into a 12K Level I simply by loading the tape.

To load the program, use the SYSTEM command just like you would with any other machine language tape. The screen will display the message in Figure 1. You answer the question about your printer (if you have one). If you're using an RS-232-C interface from Radio Shack or the Small System Hardware TRS-232, more questions will come up about nulls after carriage return, baud rate, and so forth. When you've answered all the questions, READY appears and you've got a Level I computer again.

```
BASIC1P V-2.0 (C) 1979
R.H. SHUBERT SYSTEM SOFTWARE

PRINTER INTERFACE OPTIONS:

  PRESS

    R FOR RS-232-C
    T FOR TRS232
    "ENTER" FOR CENTRONICS (OR NO PRINTER)

PRINTER SELECTION?
```

Figure 1

Level I users are probably wondering about the printer talk. Level I can't use a printer, right? Right — Level I TRS-80s can't; but a Level II using BASIC-1P can. Table 1 shows a list of commands added to Level I by this program. You not only get LLIST and LPRINT to use in your programs, but you can use the LP.ON command to make the old PRINT statements actually print on your printer. You don't even have to change your programs since it can be entered as a direct command.

Sooner or later you'll want to go back to Level II. A quick look at Table 1 shows that typing CMD "S" and an enter will return you to Level II and the "MEMORY SIZE?" message. Now, if you want to preserve BASIC-1P for later use just type 28327 and it wll be protected. To go back to it later, type SYSTEM followed by a /28327 and you're running Level I again.

Included in the four pages of documentation are instructions for converting the tape to disk (in the event you're lucky enough to have a disk system) and some tips on loading the tape. I haven't had any problems loading my copy, though. The tape my copy came on is a Scotch Highlander Low Noise tape — the very brand I've been using for almost three years on my Digital Group system, recording without any serious problems at 1200 bps. These tapes should sure work at 500!

Table 1 – Added Commands

LLIST	Abbreviated LL. This command is identical to the Level II LLIST command. It lists your program on the printer instead of screen.
LPRINT	Abbreviated LP. This command is the same as the Level II LPRINT command. It prints to the printer instead of screen.
LPRINT ON	Abbreviated LP.ON. This statement makes all the ordinary PRINT statements in your Level I programs act like LPRINTs.
LPRINT OFF	Abbreviated LP.OFF. This command reverses the action of the LPRINT ON command, restoring your old PRINTs to their normal Level I action.
CMD "S"	This command returns you to the start of Level II, that is, the "MEMORY SIZE?" message.

BASIC-1P, written by R.H. Schubert System Software, is sold by Small System Software for $19.95. The company also sells other TRS-80 products, including three machine language versions of Adventure, CP/M operating system, several action games and a program to convert system programs to disk files. Contact Small System Software, P.O.Box 366, Newbury Park, CA 91320.

WHAT'S COMING UP

SYSTEMS

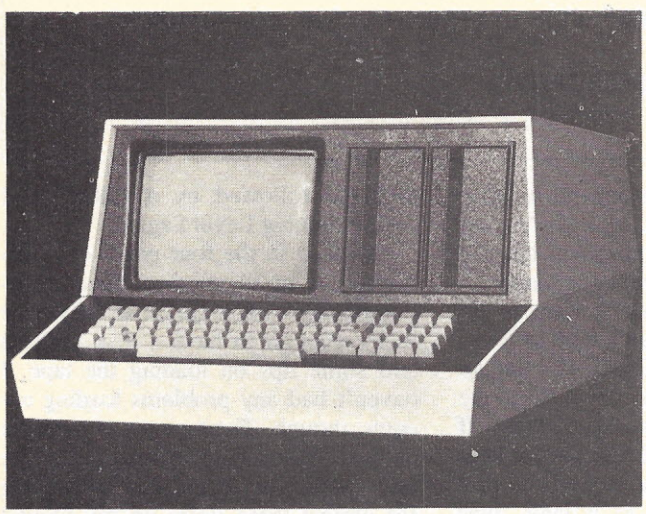
Desk-Top Computer/Word Processors

Konix International introduced its System 80 and System 81 microcomputers designed to handle small business management and professional applications as well as word processing functions. Each self-contained system incorporates video display, keyboard and dual minifloppies in one small integrated cabinet. System 80 uses the North Star operating system and BASIC language, while System 81 incorporates CP/M and CBASIC.

The S-100 compatible systems feature 32K RAM, dual Z-80 processors, dual density minifloppies and 9″ CRT as well as RS-232 and parallel I/O ports.

For information highlighting and forms design, several character attributes may be defined by the user to differentiate portions of the displayed text. Programmable reverse video, underlining, blinking reverse video, blinking underlining and protected fields provide video display flexibility.

Light weight (26 lbs) and small in size (11″ H x 21″ D x 19″ W), the systems are brown out protected and completely modular for ease of servicing. Built-in hardware diagnostics in ROM promote easy service.



The sculptured keyboard is identical in layout to an IBM selectric typewriter so that little time is spent in adapting to the keyboard in word processing applications. Numeric pad and cursor controls are standard.

Options include up to 56K RAM, battery operation and battery back-up. International options include 220 volt/50 Hz operation and Spanish keyboard.

Software available includes Fortran, Cobol and Pascal in addition to Konix application software: Executive Letter Writer word processing package and Transparent Office Manager business software.

Suggested list price is $4880. Delivery is stock to 90 days ARO. For further information contact Konix International Corp., PO Box 11666, Ft. Lauderdale, FL 33339. *Circle 108*

Computer with Hard Disk Drive

Cromemco's new Z-2H offers an integral 11-megabyte hard disk drive plus additional features including a fast Z-80A, 4 MHz processor; two floppy disk drives; 64K of RAM memory; an RS-232 serial interface; a printer interface; and a 12-slot motherboard. According to Cromemco, the system is suitable for professional work in many fields, especially business applications, word processing and data base management.

The hard-disk drive provides storage for eleven megabytes of unformatted data or over 10 megabytes of formatted data. File transfers to and from the hard disk take place six to ten times faster than in floppy disk systems, Cromemco said.

Information transfer rate to and from the disk is 5.6 megabits/second using the fast DMA controller supplied in the Z-2H computer.

Z-2H's hard disk is also designed to be reliable. The disks and drive are housed in a sealed chamber so that the user has no need to provide filtered air for the unit. Head positioning is maintained precisely despite temperature or humidity variations by using a servo track follower. Servo track following also permits the system to operate in various orientations — there is no need to level the unit before using.

Head tracking pressure is very light — just 10 grams — thereby eliminating the source of "head crashes" common with other disk drives, the company said.

With the Z-2H you also receive a copy of Cromemco's extended CDOS operating system. This CDOS has been extended to support both the system floppy disks as well as the integral hard disk. With extended CDOS you have access to Cromemco software including Fortran IV, Extended BASIC, Cobol, Ratfor, Z80 Macro Assembler, Word Processing System and Data Base Management System.

Model Z-2H comes with 64K of high speed RAM memory using Cromemco's 64KZ RAM memory cards. You can add additional RAM to give you as much as 512 bytes of RAM.

Every Z-2H is also supplied with a Cromemco Model PRI printer interface card. This card supports the Cromemco dot-matrix printers as well as the company's fully-formed character printer.

Model Z-2H computer is available for $9995. For more information, contact Cromemco, Inc., 280 Bernardo Avenue, Mountain View, CA 94043. *Circle 109*

Turnkey Business System

C.D.S., Inc., offers The Versatile Business Manager, a complete turnkey system which includes a Versatile 4 Dual Drive computer, a Texas Instruments 810 RO Tractor Feed Printer, application business software and a Formica table on rollaway casters for convenient moving.

The business software includes a General Ledger which sets up a chart of accounts and general journal, and produces a trial balance, income statement and balance sheet. It automatically posts transactions to the Ledger and produces an audit trial of transactions. Accounts Payable programs produce accounts payable statements by vendor, date or range of dates, and project the cash necessary to fulfill these obligations. Accounts Payable also prints checks and mailing stubs and journalizes transactions so they will be processed by the Ledger. Accounts Receivable produces accounts receivable statements by customer, date or range of dates as well as aged accounts receivable reports. It reports cash projections from collections and journalizes transactions for processing in the Ledger. Inventory programs produce a stock status report, and also provide materials, job cost analysis and year-to-date usage. The programs compute average and LIFO costs and EOQ'S, and also journalize transactions for the Ledger.

Personnel/Payroll programs maintain personnel records and compute payroll register for hourly and salaried employees. The programs compute and print paychecks, Quarterly 941s and yearly W-2 forms. Also, they compute labor job cost analysis and journalize payroll transactions for the Ledger.

Users can have their system in operation the first day for business applications, the company said. Price for the entire package is under $8500.

For more information, contact C.D.S., Inc., Building #3, Drummond Plaza, Newark, DE 19711. *Circle 110*

Nationwide Personal Computer Network

MicroNet merges the power and capabilities of CompuServe's large mainframe computer systems with smaller personal computer systems in homes and businesses. The MicroNet service enables customers to use CompuServe's Personal Computing Division computer system in Columbus, Ohio, from 25 major metropolitan areas in the U.S. by connecting their personal computer systems through local telephone systems.

Users can communicate nationwide with each other through a "community bulletin board" which uses CompuServe's computers and nationwide telecommunications network. Also, users can create, edit and store database files on all types of subjects, use a library of programs, and sell personally-authored programs to other customers.

For entertainment, a wide assortment of games are available such as Space War, Star Trek, blackjack, chess, golf, football and craps.

In addition, the MicroNet library contains practical, personal programs, time-saving business applications, educational aids, easy-to-use programming languages and advanced programming and diagnostic tools.

MicroNet requires modem, which allows a customer's personal computer to communicate with CompuServe's computer via telephone.

The MicroNet personal computing service is available now. Customers pay $5 per hour for the service through Master Charge or Visa bank cards.

For more information contact CompuServe, Personal Computing Division, 5000 Arlington Centre Blvd., Columbus, OH 43220; (614) 457-8600. *Circle 111*

Low-Cost System With Disk Storage

Incorporating a 2-MHz hybrid 6502 microcomputer with 64 user-definable opcodes, the Minimax system from Compu/Think provides 108,544 characters of internal memory and offers a choice of 800K bytes or 2.4M bytes of online disk storage.

With its 1920character CRT screen and resident Microsoft BASIC , Minimax is suitable for business, scientific or engineering applications, according to the manufacturer. Available software development tools and languages include a source editor program, a 6502 assembler, Autolink, a Fifth (combination of Forth and Pascal) language assembler and a PLM language compiler.

Minimax's CRT permits word or character insertion or deletion, provides a split screen mode and allows individual field editing with field protect and automatic skip to next field. Users can also produce high-resolution graphics on the 240-by-512 dot screen.

The minicomputer system stores or retrieves disk information at up to 15,000 cps. Aside from the disk port, Minimax includes a serial port that provides modem control signals and supports RS232 drivers and receivers; a printer port that supports the industry standard parallel printer interface; and a user port that contains 24 I/O ports for any required applications.

Minimax I, the version with 800K bytes of disk storage, sells for $4495. The high-end Minimax II, with its 2.4M bytes of disk storage, costs $5995.

For more information, contact Compu/Think, 3260 Alpine Rd., Menlo Park, CA 94025. *Circle 112*

Modified Pet Computer Operates as Terminal

NEC/CompuMart offers a computer and a terminal in one low-cost unit. The TC 2001 is available at an introductory price of $795 with 8K RAM.

TC 2001 combins the Pet computer, manufactured by Commodore Business Machines, and NCE's own design in a spinoff from Pet technology. The unit functions as a full duplex, dumb terminal which can be used in conjunction with remote timesharing services, and also as a personal computer. It incorporates the MOS 6502, and is available with 8K or 16K of RAM memory. The ROM memory size is 14K. THe system uses BASIC language (level II), and is expandable through IEEE, TTL parallel, second cassette and memory ports. Versions are available with either full industry standard or calculator types keyboard. Each unit includes a cassette drive.

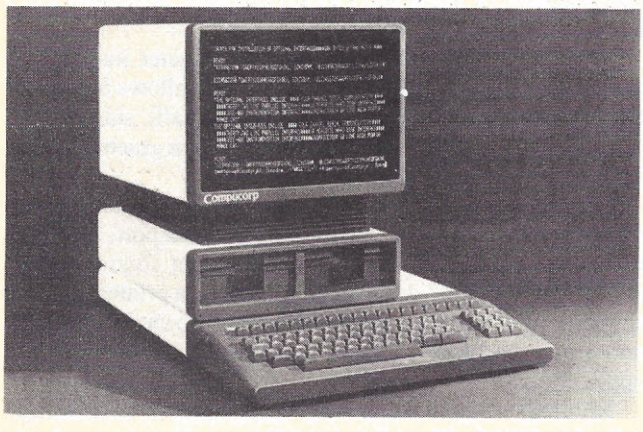
As a terminal, the TC 2001 works at a 300 baud rate. It accepts RS-232 and puts out TTL voltage. The TC 2001 has both upper and lower case characters, as well as graphics, on the 40 character by 25 lines CRT display.

A Pet computer can be converted to obtain the same terminal capabilities by plugging a module, sold through NCE for $69, into user port. NCE also offers an acoustic coupler and cable for both originate and answer mode.

NCE offers printers, plotters, disk drives, tape drives, memory expansions and other peripherals for the TC 2001. It comes with a 10-day free trial and a 90-day factory warranty. For more information contact NCE/CompuMart, PO Box 8610, Dept. P1, Ann Arbor, MI 48107; (313) 994-3200.
Circle 101

Desk-top Computer System

The Compucorp 655 is a low-cost, desk-top computer system comprised of a large screen CRT, an electronics package and a separate keyboard.



The 12-inch, 80-character by 20-line CRT screen can be positioned in any location desired by each user, said the company. The screen also tilts. The CRT has been placed behind a contrast enhancing filter to allow ease of viewing in very brightly lit rooms.

The system comes with a full international character set as well as graphics capability.

The 655 incorporates a compact, quiet electronics package containing the CPU, 48 to 60 KBytes of user memory, one or two diskette drives, each storing 163,840 characters, the power supply, input/output and expansion facilities. It can be placed on a desk directly under the viewing screen, or can be positioned out of the way.

The keyboard contains 20 program-definable keys to make system operation easy, and a full numeric cluster to allow rapid entry of numeric data.

Software for the 655 includes a library of Compucorp application programs featuring a sophisticated word processor, an auto finance and insurance package, and a variety of business applications.

The computer is also programmable in an extended BASIC language for those who want to write theirown programs. A library of programming aids and utilities includes extended BASIC; full file management system (FMS) that provides for direct and sequential files as well as a Random Sequential Access Method (RSAM); Sort; Assembler; Text Editor; Debugger; Linking Editor; and various device drivers.

Compucorp extended BASIC provides interpretive or compiled operation; 12-digit precision floating point; variable string length; multi-dimensioned arrays; logical operators; assembly language calls; FMS interface; word processing file interface; program chaining; access to the 20 program-defined keys; and full CRT data manipulation, said Compucorp. Available peripherals include a choice of high speed typewriter-quality and dot-matrix printers; and a hard disk.

Plug-in interface modules available include EIA RS-232C controllers; IEEE-488 Instrumentation Bus Adapter; and 32-line parallel interface. A Compucorp bus extender brings the 655 bus outside the module.

Suggested retail prices start at $5400. Availability is 30 days ARO.

For further information contact Compucorp, 1901 South Bundy Drive, Los Angeles, CA 90025 *Circle 102*

PERIPHERALS

Remote Control System for Commodore Computers

Honders, Inc., offers a complete home or office AC remote control system for the Commodore Pet or CBM. Virtually any electrical device can be switched on or off and lamps can be dimmed or brightened under computer control. Uses include security and energy control systems.

The basic package includes a plug-in module to the Commodore's IEEE bus interface, two remote power controllers and a complete cassette software package for demonstrations and applications.

Package price is $179. Contact Honders, Inc., Kennel Road, Cuddebackville, NY 12729; (914) 754-7106 or (212) 765-0815. *Circle 103*

77-Track Mini Disk Drive for TRS-80

Microcomputer Technology added a large capacity mini drive to its family of disk systems for the Radio Shack TRS-80 computer. Model TF-7 mini disk system features 77 tracks offering 195 Kbytes of on-line storage as compared to 80 Kbytes available on 35-track models and 100 Kbytes found on most 40-track versions. A new, 77-track version of the MTI/Apparat DOS+ disk operating system is also available.

The unit provides additional features normally found in the larger 8-inch disk drives such as door lock and automatic diskette ejection. The system comes with power supply and enclosure for $625.

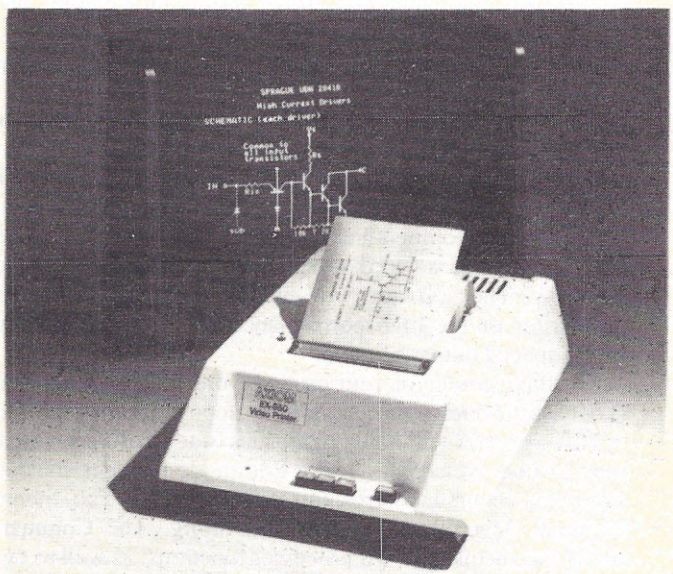
For more information contact Microcomputer Technology, Inc., 2080 South Grand Ave., Santa Ana, CA 92705; (714) 979-9923. *Circle 104*

Video Printer

A compact, low-cost video printer that reproduces any monotone graphic or alpha-numeric display in any language and character font without hardware or software interface to the CRT is available from Axiom Corp.

The EX-850 Video Printer's video controller connects directly to the video signal of any raster scan CRT display and samples information on the screen at high speed.

Using this technique eliminates the need for conventional interfacing and standard codes. The printer prints whatever is on the screen.



A 24-wire matrix printhead with overlapping print wires yields permanent reproductions on inexpensive electrosensitive paper.

The EX-850 will accept any standard video input (composite or separate video and sync) from the user's CRT terminal, TV, video monitor or computer. Front panel controls select normal or high resolution and positive or negative image. Print operation is initiated either by a front panel button or an external command.

Applications include hardcopy graphics for medical and chemical analysis; generation of maps, logos, histograms and charts; ticket printing; and printing for all foreign language character fonts and special characters.

The printer comes as a complete, stand-alone package including case, power supply, video printer controller, low paper detector, bell and paper roll holder. Price is $1250. Delivery is 45 days from receipt of order.For more information contact Axiom Corporation, 5932 San Fernando Road, Glendale, CA 91202; (213) 245-9244. *Circle 105*

Typewriter/Printer for TRS-80, Apple

A low-cost, letter-quality terminal/printer with IBM Selectric II typewriter capability and designed for the TRS-80, Apple, Sol and other personal computers is offered by Micro Computer Devices, manufacturers of compatible peripherals for the personal computer market.

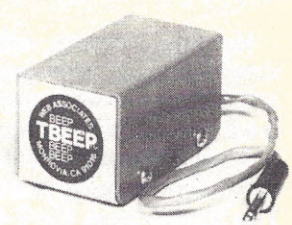
Called Selectra-Print, the combination output terminal/printer is a computer version of the IBM Selectric II incorporating customized actuator solenoids for print commands. It also retains the typewriter capability.

Standard features include 31 changeable type fonts and sizes, 15 cps speed, full upper and lower case alphanumeric display, tab commands, and backspace and index keys. Options include dual 10 or 12 pitch, correction key, tractor and pin feed, noise reduction feature and RS-232 interface.

Selectra-Print comes with an IBM factory warranty and service agreement, with a delivery time of 1 to 2 weeks.

Retail price is $1925 for TRS-80 version and $1850 for other computers. For more information, contact Micro Computer Devices, 3156 East LaPalma Avenue, Department H, Anaheim, CA 92806; (714) 630-8206. *Circle 106*

Beeping Signal for TRS-80



TBEEP, a signalling device designed for the TRS-80 Level II/Disk system or any RS-232C latched port, can be used in business systems to alert the operator that an error has occurred or that some additional action must be taken to continue processing. The device produces a clear, distinct tone, similar to that of a pocket pager, and may be easily programmed using Level II/Disk BASIC.

Powered by a 9 volt transistor battery (not included), it simply plugs in line with the AUX cable to the cassette recorder, not interfering with or making any sound during cassette operations. Disk users plug the AUX plug of their cassette cable into TBEEP's jack. In this case, the TBEEP plug is left disconnected.

While suitable for games and other applications, the device also helps eliminate the frustration of continually watching the monitor while your computer is working on such things as sorts, searches, saves or loads. Programming an "ON ERROR GOSUB" lets TBEEP signal you when an error has occurred.

TBEEP retails for $19.95. Contact Web Associates, P.O. Box 60PA, Monrovia, CA 91016; (714) 559-6249. *Circle 113*

Low-Cost Graphics Thermal Printer

A graphic option for the microprocessor-controlled Dataproducts T-80 thermal matrix printer permits interspersed graphics and text at low cost. The graphic printer can be used for quick-look evaluation of engineering, scientific, medical and industrial data or for other applications where immediate examination of plotted information is desired.

The T-80 is a five-by-seven dot matrix printer which operates at 80 characters per second. Both vertical and horizontal spacing is 70 dots per inch giving 4900 points per square inch. Distance between points is 0.014 inch.

Headings, legends, values and other text may be printed simultaneously with graphing. A standard 96-character ASCII character set is contained in ROM. Character spacing is ten per inch with six horizontal lines per inch.

An operator-replaceable print head permits printing on the fly without stopping or lifting the head between characters. This feature gives the T-80 a throughput two times greater than conventional thermal printers, the company said. Head life is 20 million characters. The printer uses conventional 8-3/4" wide thermal-paper rolls.

Standard interfaces include 8-bit Dataproducts or Centronics-type parallel interfaces and an RS-232 20 mA current loop serial interface. On-board switches permit data rates from 110 baud to 9600 baud. Other switches select even, odd or no parity.

Printer with the plotting option costs $1330. Delivery is 30 days after receipt of order. For more information contact Dataproducts Corp., 6219 DeSoto Ave., Woodland Hills, CA 91364; (213) 887-8451. *Circle 114*

SOFTWARE

Sorcerer Software

Exidy Incorporated has added a Development Pac and the Word Processing ROM Pac to their Sorcerer computer product line.

The Development Pac software allows for Z80 microprocessor assemblies, program editing and debugging. The Z80 Assembler is a two pass Assembler whose I/O can be vectored to any device driver within the Sorcerer computer, said the company. Source and object code can be spooled to accommodate programs of infinite length. Absolute assemblies and pseudo operators are also supplied.

The Development Pac has a line oriented Editor that allows forward cursor positioning, line delete and insert, input and output of source code to any device driver and spooling. The edit buffer is left intact for immediate use by the Assembler.

The debugger can display and/or modify any RAM location or Z80 program register. It will execute a program with breakpoints and generally prove useful in isolating programming problems, Exidy said.

Development Pac retails for $99 and is available 30 days ARO.

The Word Processing ROM Pac cartridge transforms the Sorcerer computer into a dedicated word processing system, said the company. You simply insert the Word Processor Pac into the program cartridge slot, rather than the Standard BASIC or Development Pac cartridge; the Sorcerer computer will respond as a word processing machine for home or business. The software will support a modified Selectric typewriter or the high performance Diablo/Qume proportional spaced output printers.

For data storage of your printed word, either an inexpensive cassette audio recorder or mini-floppy disk may be used. A 32K Sorcerer will hold eight pages of test before saving to tape or disk is necessary. The Edit mode includes standard functions of cursor control, Insert/Delete, Scan, Tab, Indent, Hyphen, Macros, pagination and titling. The Command mode has the usual word processor functions, as well as tape merge with memory, line length set (15 to 120 characters), printer option set, string search and display of unused space. File names may have up to eight characters.

The Word Processor Pac retails for $99.

For more information on these products contact Exidy Data Products, 390 Java Drive, Sunnyvale, CA 94086. *Circle 115*

Earned Income Payroll Software

A new small business software package from California Business Computers can handle full-measure payroll activities for firms of up to 80 employees. The package incorporates earned income credit provisions and pre-programmed federal and state tax tables.

The software allows small business operators to streamline record-keeping and payroll accountability as well as cost accounting, the company said. The system utilizes CP/M and C-BASIC 2 and is available in 8" or 5-1/4" formats.

Price is $595. For more information contact California Business Computers Corp., 825 West Hamilton Ave., Campbell, CA 95008; (408) 866-6306. *Circle 117*

Graphics Programs for TRS-80

Microsketch II is written in Radio Shack TRS-80 BASIC (16K Level II or 32K disk). When loaded under Disk Basic, it takes advantage of random access files for rapid screen or command string storage and retrieval. In addition to the main system, Microsketch contains five subsystems: Automatic Pattern Designer, Typewriter, Big Print, Graphic String Creation and Command String Creation.

The main system includes 58 commands and can create a variety of graphics. Horizontal, vertical and diagonal lines may be drawn by holding down the arrow keys or the "1", "Z", "/" and "-" keys. The cursor may be moved to any position on the screen without disturbing the graphics already drawn. Either white lines on a black background or black lines on a white background may be drawn. This feature may also be used to erase lines previously drawn. The user has a choice of drawing either normal width or double width lines. The entire screen may be reversed at any time (white areas become black and vice versa). The top half of the screen may be folded down (the bottom half is replaced by a mirror image of the top) and the left half may be folded to the right. The entire screen may be cleared; but in addition, any single quadrant may be cleared independently. Two screens may be added together (merged). The entire screen may be "rotated" up, down, left or right. The screen may be saved or loaded from tape, disk or main memory.

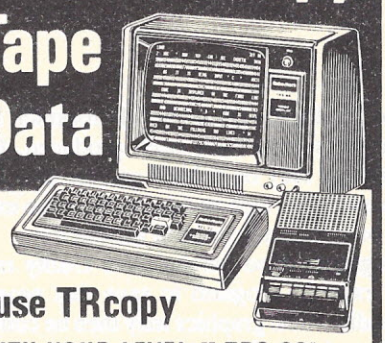
The Automatic Pattern Designer subsystem produces a variety of intricate patterns.

In the Typewriter subsystem, the computer works exactly like an electric typewriter. Holding down any key causes it to repeat.

The Big Print subsystem features ten different character sizes. Oversized characters are produced simply by pressing keys on the keyboard. The characters must be typed on a black background, but may be reversed by returning to the main system.

The Graphic String Creation subsystem aids program development, producing graphic strings automatically. The user simply moves a special cursor over the portion of the screen to be converted. For disk users, a mergeable ASCII file may be produced. For non-disk users, the string assignment

See and Copy Tape Data



use TRcopy

WITH YOUR LEVEL II TRS-80*

TRcopy is a cassette tape copying system that lets you SEE what your computer is reading.

COPY ANY CASSETTE TAPE**

With the TRcopy system you can copy any TRS-80 Level II cassette tape whether it is coded in Basic or in machine language. You can also copy data created by programs and you can copy assembler listings.

YOU CAN SEE THE DATA

As the tape is being loaded, you can SEE the actual data byte-for-byte from the beginning to the end of the program. Up to 320 bytes are displayed at one time. ASCII characters are displayed on the first line and hexadecimal code is displayed on the following two lines. Data is displayed exactly as it is input including memory locations and check sums.

IDENTIFY PROGRAMS

With TRcopy you can identify programs on cassette tapes without written documentation because you can SEE the filename. If you forget to label a tape, you can use TRcopy to display the tape contents and identify the cassette.

VERIFY CASSETTE TAPES

With TRcopy you can verify both the original tape and the tape copies. You can make certain that your machine reads the original tape correctly and that it makes byte-for-byte copies. TRcopy also counts as it reads giving you the exact length of the data.

MAKE BACKUPS FOR YOUR PROGRAMS

Now you can make backup copies of your valuable programs. Many times a cassette that you make will load better than one that is mass produced. The original can then be kept as a backup in case the copy is damaged.

MAKE COPIES OF YOUR SOFTWARE

If you are in the software business you can use TRcopy to make tested copies of your programs for sales distribution. TRcopy produces machine language tapes that are more efficient than those produced by the assembler itself.

RECOVER FAULTY DATA

With TRcopy you can experiment with the volume and level controls and you can SEE what the computer is reading--even if your computer will not read the data through normal read instructions! In this way it is possible to read and copy faulty tapes by adjusting the volume control until you SEE that the data is input properly.

SIMPLE – FASCINATING – FUN

TRcopy is not only a practical utility program. It is also a fascinating graphics program that lets you SEE, for the first time, cassette data as your computer is reading it. And it's as simple as 1-2-3. Just load, verify and copy. You will now be able to use cassette tapes with confidence knowing that TRcopy is there when you need it.

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CIRCLE 25

statements may be produced within the Microsketch II program itself. After the strings have been produced, the remainder of the program may be deleted and the string statements may then be saved on tape and merged into an existing program or a new program may be built around them.

An auxilary program called Screen Save Utility may be merged with any existing program to save that program's graphics on tape or disk. The graphics may then be converted into strings by Microsketch II for inclusion in the same or other programs. Both Level II and disk versions of this program are available.

Microsketch II includes 10 pages of documentation. The programs are distributed on Maxell low-noise cassettes. Price for each program is $3.95. Contact International Data Services, P.O. Box 4908, Philadelphia, PA 19119. *Circle 118*

North Star Software

California Digital Engineering announced the availability of Bowling Secretary, Edit/Sort-I and Format-I for North Star Horizon microcomputers.

Edit/Sort-I provides editing and basic word processing functions plus a versatile and powerful sort which allows sorting on any combination of variable length fields in each record. It also offers selective printing, which lists only records with a specified key. Applications include phone, record, appointment and data lists.

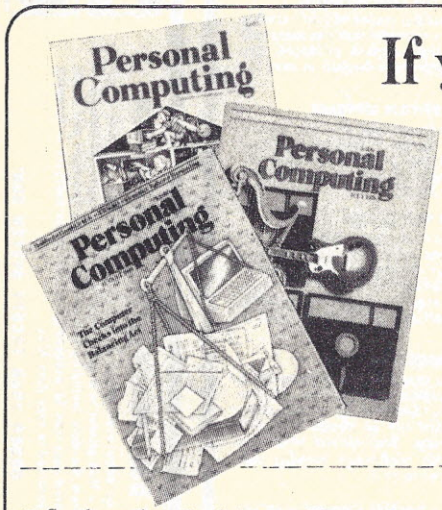
Format-I, a word processor and text editor combined, handles word processing applications ranging from letter writing to manuscript or document preparation. A text file created by the text editor is formatted and printed according to commands embedded in the text file. Functions include page numbering, heading, centering, underlining and right justification.

Bowling Secretary keeps track of all scores for any size league and prints complete weekly results.

These programs require a minimum of 24K bytes (starting at 0) of RAM and one floppy disk (single or double density). Each program can be contained in ROM from 0 to 1FFF hex. Bowling costs $55; Edit/Sort, $65; Format-I, $120. For more information contact California Digital Engineering, 1537 Shenandoah, Los Angeles, CA 90035. *Circle 119*

Computer Program Tapes

Hayden Book Company's line of computer program tapes includes Backgammon, Crossbow, The First Book of KIM (Tape 3), Mayday, and Batter Up.



If you're missing any of these you have gaps in your data bank.

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Backgammon, a game involving skill and luck, lets you play against your TRS-80. A player can develop and add new strategies and use an optional dice roll control. A guide includes the complete rules of the game as well as loading instructions and a brief program description broken down by line numbers. The program is available for TRS-80 Level II and for Pet for $10.95.

Crossbow teaches fractions while engaging up to 9 players in a competitive target game. Three levels of play are available for ages 7 to adult. Level I teaches recognition of fractional quantities and allows the player to use a ruler to help determine the position of the target on the screen. Level II increases judgment of fractional quantities since the ruler is not displayed until after 4 misses. Level III generates both a target and a fraction. The player must then add or subtract a fraction. The resulting sum or difference is the position the arrow will strike — hopefully, that position will also be the target!

The program is available for the Pet for $9.95.

The First Book of KIM, Tape 3, consists of 13 utility and diagnostic programs to help you test your KIM-1 system and expand its capabilities. The programs are: Branch, Browse, Directory, Hypertape, Memory Test, Mini Dis, Movit, PLL Set, Relocate, Sort, Super Dup, Verify Tape and Vu Tape. The program is available for KIM-1 for $9.95.

Mayday is an airplane flight simulation. Imagine you're the pilot of a private plane. Three miles from your destination you run out of gas. One thing is certain; you are going down! Can you save yourself? Or will you crash? The player learns the basic principles of flight: how to control lift, drag and weight; to flare at the proper moment; to control vertical speed and recognize ground effect; and to use the ILS and VASI landing aids. And every flight is different because you start at a different altitude.

Mayday is available for the Pet for $9.95.

Batter Up, a microbaseball game by Karl Savon, tests a player's batting skill through three levels of play: a duel between pitcher and batter; fielding; and advancing base runners. Display includes an updated scoreboard showing number of pitches, bases on balls, hits, runs, strikeouts and ERA. The program is available for Pet or TRS-80 Level II for $10.95.

For more information contact Hayden Book Company, 50 Essex St., Rochelle Park, NJ 07662. *Circle 120*

Level II BASIC Shorthand

Web Associate's TSHORT, a Level II BASIC shorthand, gives you single shifted key stroke entry for 32 difficult to type, long and/or repetitive commands. TSHORT saves pro-

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REMODEL + PROLOAD for $34.95 (Specify 16, 32, or 48K version)
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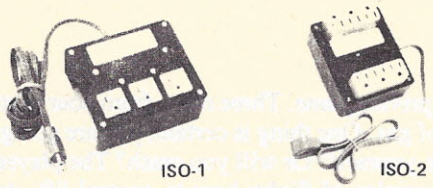

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* CP/M is a trademark of Digital Research Corp.

CIRCLE 28

gramming time, and, helps eliminate syntax errors. Immediately after each single key stroke entry, the entire command is spelled out in its normal format (letter for letter) on the monitor and/or listing. A Kustom key provides user-defined functions up to 64 characters of instruction as well as a self-executing "GoTo 10" function (line 10 may contain "RUN").

TSHORT includes commands such as RIGHT$(, LEFT$(, INPUT, CLOAD, USING, GOSUB, LIST, EDIT, RETURN and CSAVE"A.

The program comes on cassette — one side for Level II BASIC and the other TRSDOS/NEWDOS. Pressure sensitive decals (white letters on clear), which come with each cassette, are easily placed on the front surface of each key on your keyboard, to identify each shorthand key function.

TSHORT runs in 580 bytes of low memory, thus not interfacing with BASIC, DOS or user machine language routines.

Price is $9.95. Contact Web Associates, P.O. Box 60 PA, Monrovia, CA 91016; (714) 559-6249. *Circle 121*

TRS-80 BASIC Enhancements

Infinite BASIC adds over 70 non-trivial BASIC commands to TRS-80 BASIC. Any combination of these commands can be packaged and loaded into any selected memory location to minimize memory requirements.

Matrix functions added by Infintie BASIC include: matrix read, inverse, transpose, identity and simultaneous equations; add, subtract or multiply scalars, vectors or multi-dimensioned arrays; dynamically reshape, expand, delete arrays; change arrays in mid-program; copy array elements, set arrays to scalar, zero arrays, move arrays; tape array read and write including string arrays.

String functions include: left and right justify, truncate, rotate, text justification, string centering; deletion or insertion of substrings, pack strings, convert to upper or lower case; translate characters, reverse strings, verify function, test number of occurences; masked string searches for simple or array variables; encrypt or decrypt strings; compress/uncompress character string arrays to six bits or less per character. Also, you get machine language sorts — multikey multivariable and string — which sort 1000 elements in nine seconds.

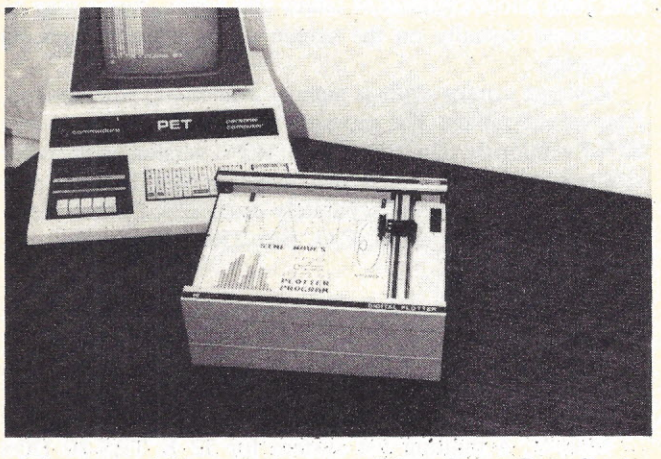
Infinite Business, an add-on package to Infinite BASIC, helps you develop business applications packages. Infinite Business includes multiple precision packed decimal arithmetic to eliminate round-off error with 127-digit maximum accuracy; binary search of sorted arrays, insertion of new elements in sorted arrays; automatic page headings, footings and pagination including forced end-of-page; and automatic hash for record retrieval.

Future Infinite BASIC add-on packages will include Infinite Statistics, Infinite Input/Output and Infinite Graphics.

Infinite BASIC costs $49.95; Infinite Business is $29.95. For more information contact Racet Computes, 702 Palmdale, Orange, CA 92665; (714) 637-5016. *Circle 122*

Hardcopy Graphics for Pet

West Coast Consulants announced software which provides Pet users with full graphics capability for Houston Instrument's Hiplot plotter. The program, available on tape cassette, drives the plotter through an RS-232 interface. Priced at $50, the program is written in BASIC and offers sophisticated plot control by means of several subroutines. Minimum memory requirement is 16K bytes. Similar programs are in the works for both TRS-80 and Apple II computers.



For more information contact West Coast Consultants, 1775 Lincoln Blvd., Tracy, CA 95376. *Circle 123*

Pet Word Processor

Textcast turns Pet/CBM microcomputers into word processors for preparing rough drafts, finished manuscripts, letters, invoices and data files. The program consists of 29,800 bytes of machine language subroutines plus an executive routine in BASIC. It works with first or second generation machines in 8K, creates files with one recorder, edits files with two recorders or a Commodore disk, and prints formatted documents with a printer at the IEEE port.

The keyboard provides caps and lower case as on a regular typewriter, and the program makes conversions for obtaining caps and lower case on a printer.

Features include easy flow typing without hitting return and screen editing functions on the keyboard — line deletion and insertion, shifting blocks of text, paragraph reformatting for word deletions and insertions, and two extra cursor keys.

Printing options include right justification, line centering and underlining (or letter enhancement and reversal with Commodore printers).

Machine language subroutines speed writing and reading of files. Files are reviewed a screen at a time with file names displayed at the beginning and end of review. Lines from the last screen can be reviewed. Fast-Forward and Reverse can be used while reading tapes.

The program deletes, inserts or changes characters, words or lines during editing. A file may be extended at its end, or

ANNOUNCING

TRS-80*
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other files may be concatenated to it.

Files can be edited on a single disk, or from disk to disk, disk to tape, tape to disk and tape to tape. Textcast files can be read by other programs using GET or INPUT statements. A special command inserts variable delimiters in data files.

Line length for printed output may be set between 30 and 80 characters. The program will indent paragraphs or block paragraphs with blank lines between. Any number of lines per page can be printed on any size page, on separate sheets or on continuous forms. Pagination is provided when printing continuously. Printer commands for tab, backspace and line feed allow creation of tables and forms, forms may be composed visually on the screen using a special spacing character.

Textcast comes with a manual containing illustrations, figures and tables. The program is available on tape (early ROM version on one side; current ROM version on the other side) or on diskette. Tape plus manual is $60. Diskette plus manual is $65. Manual separately costs $20. Contact Textcast, Cognitive Products, P.O. Box 2592, Chapel Hill, NC 27514. *Circle 124*

Mail List for TRS-80

Mail-V, a mailing list system for 32 K TRS-80 DOS systems, can be used with other Series V systems, such as Word-V, which will get the mailing list infomation and produce personalized letters. INV-V will get the name and address information for printing purchase orders.

Screen input and edit features let you move the cursor, delete character, line and replace characters by typing over.

Mail-V includes a report writer, which allows you to specify the report or label formats on-line. Selection criteria, field calculations and multiple-sort keys are supported. One or more labels across a line can be selected.

Fields include new Zip code extensions, last reference date and remark field. A selection code ranging from 0 to 32,000 is used to classify labels.

Unlike many programs, you do not have to sort the entire data base everytime you add records. You can use the entire diskette for storing data; sorting the entire file takes only minutes. The system provides a separate module to handle sorting numeric Zip codes. Any fields can be sorted or searched.

The program on diskette costs $59 with full documentation. Manual alone is $5. CP/M version will be available soon. For more information, write to Micro Architect. 96 Dothan St., Arlington, MA 02174. *Circle 125*

General Ledger Package

Improved user flexibility and speed are among the enhancements in Ecosoft's new General Ledger. A Skip Sequential file structure performs disk write operations with the speed of random access files, but is not limited to fixed file

lengths, resulting in increased speed and simultaneous conservation of disk space, the company said. Other features include direct cursor control for popular video terminals, monthly financial reports for either manufacturing or service firms, and a version that permits CPAs to service clients on a "one-disk-per-client" basis.

The 75K General Ledger package is divided into 18 subprograms, reducing hardware requirements to 12K of user memory, one or more disk drives and optional printer. Price is $99.95.

Ecosoft also offers other business, scientific and educational software packages. Each package uses Release 4 or later North Star DOS and BASIC, single or double density. Programs are shipped on diskette with comprehensive operator's manuals. Delivery is from stock to 10 days. Contact Ecosoft, P.O. Box 68602, Indianapolis, IN 46268. *Circle 126*

Multi User-Operating System

Ohio Scientific has announced its new multi-user operating system, the OS-65U Level 3, for its C3-C computer system. The C3-C utilizes a 29 megabyte Shugart Winchester disk, which, in conjunction with OS-65U Level 3, supports up to 16 independent users via dedicated memory partitions of up to 48K each.

The Level 3 operating system is also available for the C3-B, which incorporates a 74 megabyte Winchester disk and Ohio Scientifics's line of floppy disk based computers.

This operating system supports both dumb and intelligent terminals via direct connection to the computer or via telecommunications links, and allows Ohio Scientific business applications packages to be expanded to multiple users and timeshare operations.

Available packages include OS-AMCAP, a fully integrated small business accounting package and OS-DMS, information management system. Together, these packages provide accounts receivable and payable, general ledger, inventory control and general information capabilities for Ohio Scientific computers, said the company.

For more information contact Ohio Scientific, 1333 Chillicothe Rd., Aurora, OH 44202; (216) 562-3101. *Circle 127*

TRS-80 Level II Telephone Dialer

Software Exchange now offers a TRS-80 Level II version of its Telephone Dialer Program. The new program is identical to the original except it runs in Level II instead of Level I. Using the program, your TRS-80 can dial the telephone. Applications include aiding the handicapped or assisting your baby sitter. For example, in case of emergency, the sitter could type "P" to dial the police or "F" for the fire department.

No internal connections are made to the computer, but the program requires a $4 interface made from Radio Shack parts. Twenty phone numbers can be stored and used with

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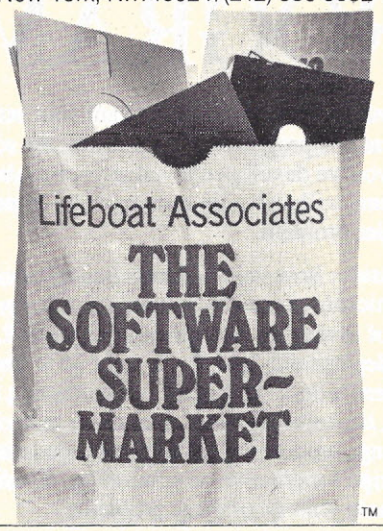

DR. DALEY'S SOFTWARE FOR THE PET

DR. DALEY's software continues to expand offerings. Listed below are our newest business offerings. With the new PET disk and printer these programs make sense for the small businessman. Dealers you should be able to increase your sales to the businessman by giving a demonstration of these programs. These programs are available NOW for the Compu/Think disk and will be converted to the Commodore Disk as soon as DR. DALEY's gets one.

INVENTORY This program will maintain a complete inventory for the small business. Functions include entering and editing of the new inventory, modifying individual records, closing out files for the end of the year inventory report, printing the current inventory and displaying the individual record. This consists of three programs capable of maintaining a complete inventory. With complete documentation. **$99.95**

ESTIMATE This set of four programs will build a file for use, in conjunction with the above inventory files, to prepare accurate estimates for an individual job. Small businessmen have told us that the preparation of an accurate estimate for a job is the most time consuming and inaccurate operation he has to perform. This program can eliminate the difficulties and inaccuracies of this operation. With complete documentation. **$99.95**

MAIL LIST This program will maintain a mailing list and will allow sorting of the list into subgroups using up to three search parameters. The program maintains the files in zip code sequence. The initial entries are sorted into the proper zip code order and all subsequent entries are entered into the proper place in the file. Will display the lists on the screen or will print it on labels (three wide). Will allow about 6000 names. **$99.95**

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CIRCLE 33

WANTED:

BUSINESS PROGRAMS

Personal Computing readers want your business applications programs. Chances are, the software you've developed to solve your business problems will also help someone else faced with a similar problem.

Consider how your business benefits from your microcomputer — not only in the obvious areas of inventory, accounting and payroll, but in all departments and levels right up to the president's desk. Financial and marketing analysis, time management, planning, materials handling, product design and cost accounting are areas ripe for creative programming. Readers want help with all of these problems.

So why not share your solutions with our readers? Send us an article describing the problem you faced and how you used your microcomputer to solve it. Be sure to include a program description, program listing and sample run.

Remember, readers aren't familiar with your program. So explain in detail what the program does and how it does it. Include here the overall structure of your program as well as any special algorithms or routines you've used. Give suggestions for modifying or expanding the program for other applications, other businesses or other situations.

All submissions should be original, typed (not all CAPS), double-spaced and neat. Include your name and address on the first page of the article and enclose a self-addressed, stamped envelope for return of material. Also, please use a fresh ribbon on your printer for program listings and sample runs.

Feel free to call us at (617) 232-5470 if you have any questions or want to discuss specific article ideas.

Mail your manuscript to:

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Personal Computing
1050 Commonwealth Ave.
Boston, MA 02215

either dial or pushbutton telephones.

Price is $7.95, including the program on cassette and instructions with interface circuit diagram and parts list. For more information contact Software Exchange, 2681 Peterboro, W. Bloomfield, MI 48033. *Circle 128*

CP/M Software

Lifeboat Associates offers two new compilers for CP/M-based microcomputer systems.

C Compiler supports most major features of the "C" language including structures, arrays, pointers and recursive function evaluation. Linkable with library to 8080 binary output, it lacks data initialization (long and float type) and static and register class specifiers. Price is $110 ($15 for manual alone).

BASIC Compiler is compatible with Version 5 Microsoft ANSI BASIC interpreter but has 3 to 10 times faster execution, said the company. Standard Microsoft relocatable binary output is produced. The compiler is supplied with a Macro Assembler which produces compatible linkable modules. In addition, Lifeboat Associates also supplies ANSI COBOL and ANSI FORTRAN compilers which generate compatible load modules. Price is $350. ($25 for manual alone).

Lifeboat also offers CP/M for the Altair disk system, making CP/M-based software available to Altair users. The basic CP/M package includes text editor, assembler, debugger and various other system utilities plus six users manuals. Lifeboat's CP/M operates directly with systems configured for Altair Disk BASIC, and offers over 20% more storage than standard soft-sectored disk systems, the Company said. All programs designed to run under CP/M will operate with this system. Price is $145.

For more information contact Lifeboat Associates, 2248 Broadway, New York, NY 10024. *Circle 129*

TRS-80 Disk Operating System

Microcomputer Technology, Inc., offers a powerful Disk Operating System, DOS+, in 35 or 40 track versions for TRS-80.

DOS+ was developed by Apparat, Inc.,to fill the need for an easy-to-use, bug-free way to access disk from user programs. The system includes over 200 modifications, corrections and enhancements to Radio Shack's TRS DOS 2.1, according to MTI.

The MTI/Apparat DOS+ enables any program to execute all TRS-80 commands. It also works with assembler language programs or high level languages that use DOS routines for character input and output.

Some of the added features of the new DOS+ include:

- Basic reference command for variables and numbers
- Fast machine language RENUM program executable under BASIC
- Built-in keyboard debounce routine

- Print screen option under DOS or BASIC to a line printer
- New copy commands for back-up, allows copying from drive to drive while keeping the same filespec
- Execution of DOS commands while in BASIC
- New BASIC scrolling and invocation commands
- Apparat's "Superzap", a hexdump utility to examine or modify disk or memory locations
- Modified Editor/Assembler with disk I/O and new cross reference feature
- Fast machine language Diassembler program
- Load Module for transferring machine tapes to disk
- Faster disk access
- Level 1 ROM relocated in Level II RAM.
- Capability of storing and retrieving Level I programs on disk
- Improved Diskdump program
- DIRCHECK program to test a directory and List/Display the contents in alphabetical order, with extensions

Available for immediate delivery, DOS+ comes with manual, diskette and several APPARAT disk utility programs for $99 for the 35 track version, and $110 for the 40 track version.

For more information contact Jerry Washburn, Microcomputer Technology, Inc., 2080 S. Grand Ave., Santa Ana, CA 92705; (714) 979-9923. *Circle 130*

Sort/Merge Utility

Better Programming Systems has announced a new, high-speed Sort/Merge utility designed for the Ohio Scientific OS-65U operating system (minimum 32KB main memory), BPSORT features full-disk sorting (floppies or up to 74 megabyte hard disk storage) with five ascending or descending keys. Maximum record or field size is 255 bytes. Fixed or variable length fields are permitted. Sorting parameters are established using a simple, interactive BASIC program.

BPSORT allows OSI users to sort hundreds of records in just seconds, said the company. BPSORT and documentation are supplied on an eight-inch floppy diskette or $99 and are available at local Ohio Scientific dealers or from Better Programming Systems. For more information contact Better Programming Systems, Inc., 322 West 57th Street, Suite 9C, New York, NY 10019; (212) 765-0815. *Circle 131*

Disk Operating and File Management Software

Flex 2.0, a disk operating and file management software package for the 6800, is now available for Tano Outpost 11 computers. Originally developed by Technical Systems Consultants, Flex 2.0 was adapted by Great Plains Computer Co. for the Tano system, making the system compatible with Flex business software already available. Flex software currently available from Great Plains Computer Co. includes mailing list, word processing and business accounting.

Price for Flex is $150, including documentation, Flex 2.0 disk with utilities and boot loader ROM. Contact Great Plains Computer Co., Inc., 3460 Taylor View Lane, Ammon, ID 83401; (208) 529-3210. *Circle 116*

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30 LINE-N
40 GOTO 10

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CIRCLE 34

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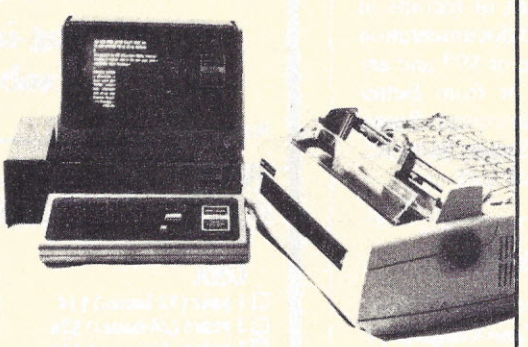

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CIRCLE 35

COMPLEMENTS

System Enhancements for your Computer

The Bottom Shelf offers two devices to enhance your computer system.

Their Disk Drive Head Cleaner for the TRS-80 comes in mini diskette form and is reusable on both sides. In addition, a program is included that does the cleaning thoroughly and automatically. Cleaning solution is also provided. The Disk Head Cleaner will allow more reliable disk drive operation and save the user the cost of head cleaning maintenance, TBS said. price is $12.95. TBS says they are in the process of developing the cleaner for other computers.

Lightning Buster is a device guaranteed to protect your computer from power surges up to 1000 amps. A three-plug adapter goes into any three prong 125V, 15A wall outlet. The device is guaranteed for one major surge. Price is $14.50. For more information see your local TBS dealer or contact The Bottom Shelf, Inc., P.O. Box 49104, Atlanta, GA 30359; (404) 939-6031. *Circle 144*

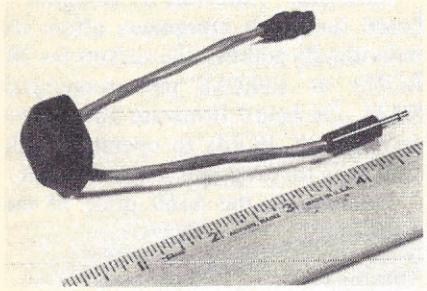
TRS-80 Cassette Hang-Up Fix

TRS-80 cassette drive hang-up often occurs when the user is running a lot of data saves or loads, during which the cassette recorder is turned on and off several times a minute. The failure, caused by a phenomenon known as microwelding, occurs as a result of excessive current and heat build-up in the TRS-80 cassette control reed relay. The microwelding is further aided by a slight, self-holding, electro-magnetic force induced by the high recorder current. This added electro-magnetic force is why, in most cases, the hang-up goes away when the cassette recorder is manually turned off.

To provide a simple, inexpensive, permanent fix, Web Associates developed their TBUFF module. TBUFF, no larger than an ice cube, simply plugs in line with the Remote cable between the TRS-80 and the cassette recorder.

TBUFF reduces the current passed through the reed relay. At the same time, TBUFF delivers full power to the recorder, thus maintaining proper tape speed and volume levels.

The device is available in two models: TBUFF-N and TBUFF-R. N is designed for the CTR 33, 41, 43 and 46 or any recorder whose REM jack polarity has negative at the center (tip) and positive at the shell (ring). R is designed for CTR 21, 40, 47 and 80 or any recorder whose polarity is opposite to N.



Web requests the CTR model number or REM jack polarity (in the case of non-Radio Shack recorders) accompany each order. TBUFF retails for $9.95.Contact Web Associates, P.O. Box 60PA, Monrovia, CA 91016; (714) 559-6249. *Circle 143*

P.C.BOARDS

Permanent Memory Intelligence for Peripheral Interfaces

Microproducts announced the Interface Brain, a device that plugs directly into your Apple II computer to provide permanent memory intelligence for versatile, flexible and inexpensive so-called "dumb" peripheral interfaces. It supplies permanent full-time availability of firmware drivers for the Centronics 779, PR-40 and Okidata printers as well as the Microproducts EPROM Programmer the instant your computer is switched on. The device allows the flexibility of a user changeable EPROM where situations of software or hardware update indicate a change is desirable or necessary. The Interface Brain is supplied on an EPROM, set in a Microproducts EPROM Adapter Socket, to permit direct insertion into the D8 ROM slot on your

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CIRCLE 37

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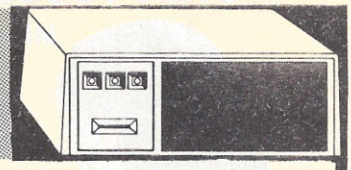

New! Computerized burglar alarm requires no installation.
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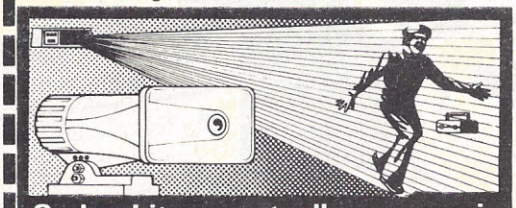

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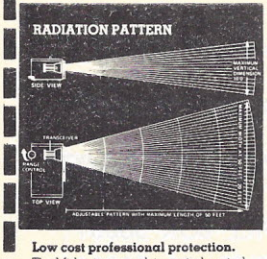

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CIRCLE 38

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U-DRAW II ™ (32k) $39.95, a complete graphics package for the Apple II with disk. You can create a figure and rotate, expand, contract or move it anywhere on your video screen with a few simple keystrokes. Save individual figures or complete drawings on disk and recall them later. U-DRAW II automatically builds and edits multi-figure shape tables that are directly transferable to your BASIC programs. You won't find better graphics capabilities at 100 times the price!

DR. MEMORY (32k) Disk Word Processor $49.95 includes UPPER and lower case plus complete printer controls. Variable page size, left and right margins, automatic paragraphing and more. On diskette with documentation.

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CIRCLE 39

WHAT'S COMING UP

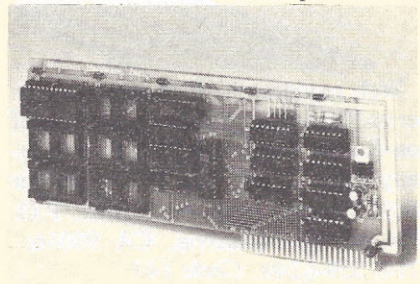
Apple II, along with documentation. Price is $59.95.

Apple II Interface Brain is available from local computer stores or from Microproducts, 2107 Artesia Blvd., Redondo Beach, CA 90278; (213) 374-1673. *Circle 133*

Apple Firmware Card

Mountain Hardware's Romplus+ board for Apple computers offers six individually addressable sockets for 2K ROMs or EPROMs plus scratchpad RAM. On-board firmware allows two or more 2K ROMs to operate simultaneously for programs longer than 2K.

Included in the $169 price of the



Romplus+ board is a 2K ROM program, "Keyboard Filter", which offers upper/lower case for the Apple, multiple user-defined character sets, colored or inverse-colored letters, keyboard macros, improved cursor control, and other improved control functions. The program works with Integer BASIC, RAM or ROM Applesoft and DOS.

Software support, provided on disk, includes demonstration programs and two Editors that allow users to define their own characters and keyboard macros, including BASIC and DOS commands.

For more information, contact Avery Dee, Mountain Hardware, Inc., 300 Harvey West Blvd., Santa Cruz, CA 95060. *Circle 134*

LITERATURE

TRS-80 Business Software

TRS Yellow Pages, issue 1.4, is a

twelve-page guide for selecting business software for the TRS-80. It describes all the software produced by Micro Architect. This issue features a sophisticated data base manager for the TRS-80. For a free copy, send two stamped, long, self-addressed envelopes to Micro Architect, 96 Dothan St., Arlington, MA 02174. *Circle 135*

Guide to Business and Personal Microcomputers

MicroShopper, guide to business and personal microcomputers, is available from The Phoenix Group. The 72-page reference book features 150 detailed photographs plus over 500 products from more than 100 manufacturers.

The book's introduction offers a common sense approach to computer jargon, and business systems and software are discussed in non-technical terms. Pictures and a concise glossary of terms aid understanding.

The latest edition of *MicroShopper* is available from MicroAge and local computer dealers as well as through retail electronics stores, bookstores and other retail outlets.

Price is $3.95 retail, or direct from P.G.I. Publishing for $5, which includes postage and handling.

For more information contact P.G.I. Publishing, 1425 West 12th Place, #106, Tempe, AZ 85281; (602) 894-9247. *Circle 136*

TRS-80 Publication

Systems Extensions is a 128-page publication consisting of one half text material and one half catalog. Seventeen articles give a general overview of data processing with particular points of interest for TRS-80 owners. The second half is a catalog listing over three hundred items useful for all microcomputers. The software section features twelve programs for the TRS-80.

Price is $3. For more information see your local TBS dealer or contact The Bottom Shelf, Inc., P.O. Box 49104, Atlanta, GA 30359. *Circle 137*

Free Apple Software Catalog

A new Apple Software Catalog has been released by Rainbow Computing. The new 45-page book includes over 100 games, business applications and software development programs.

Rainbow Computing developed several of the programs contained in the catalog.

For a free copy, write or phone Rainbow Computing, 9719 Reseda Blvd., Northridge, CA 91324; (213) 349-5560. *Circle 138*

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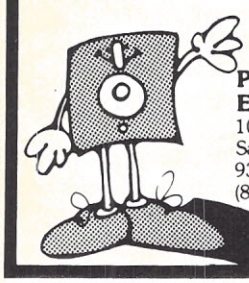

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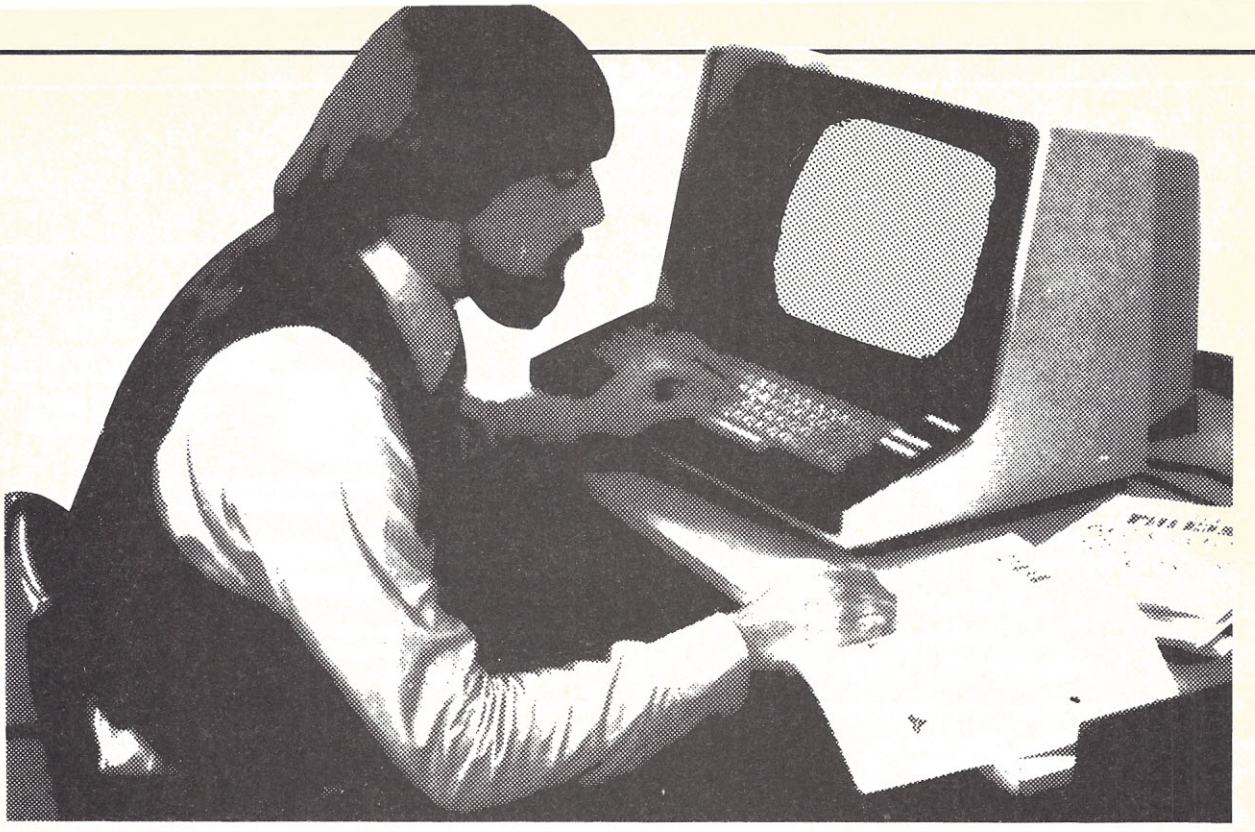

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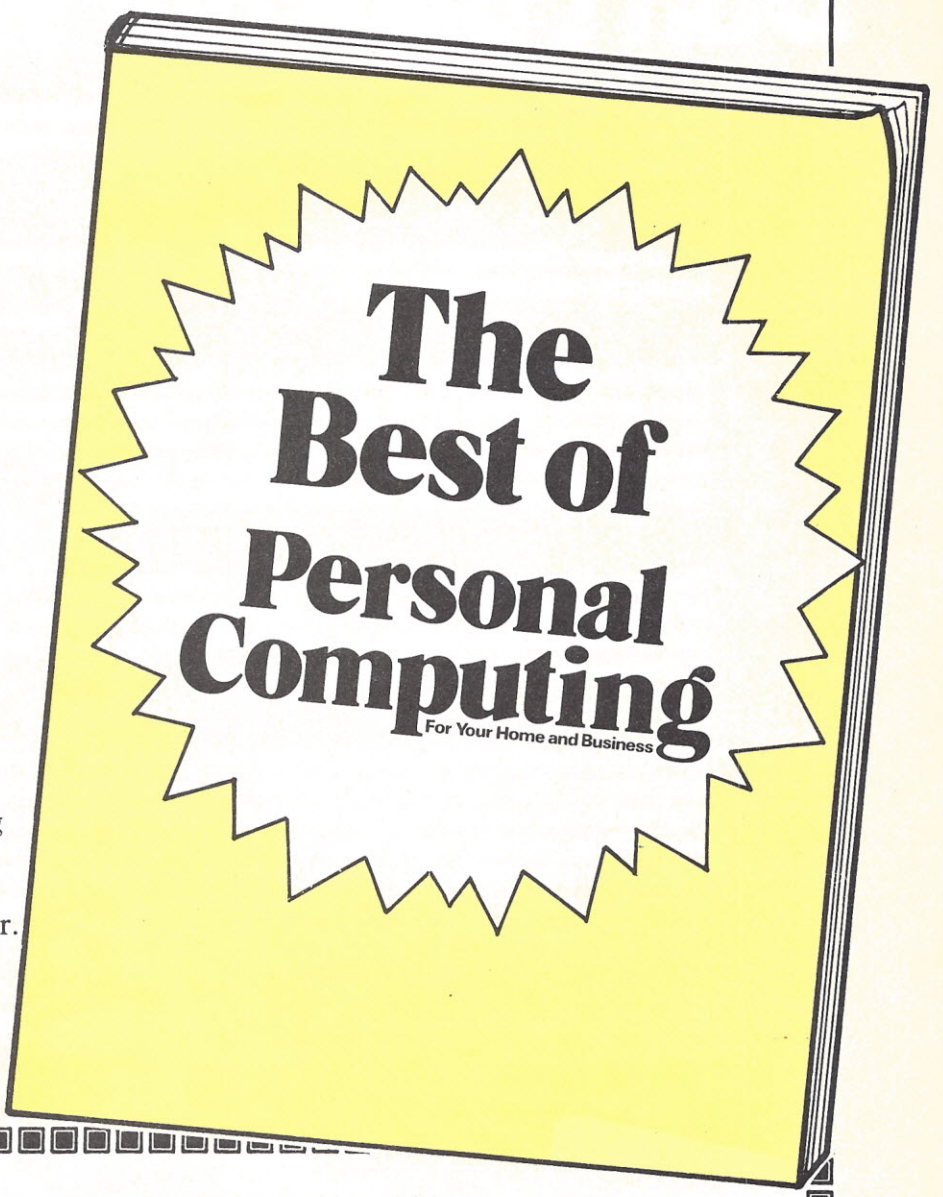

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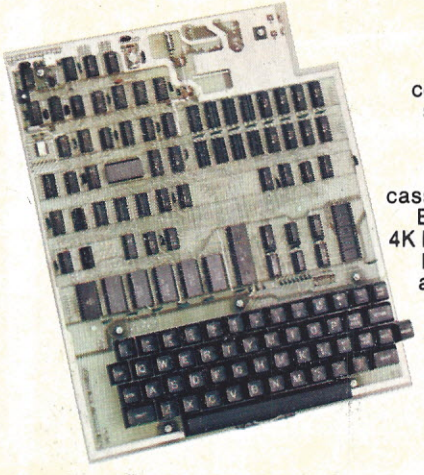

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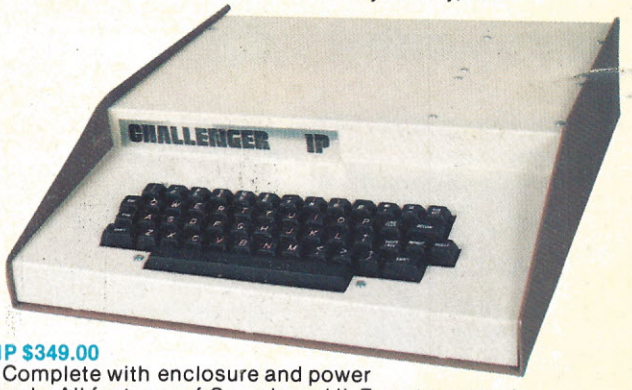

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